

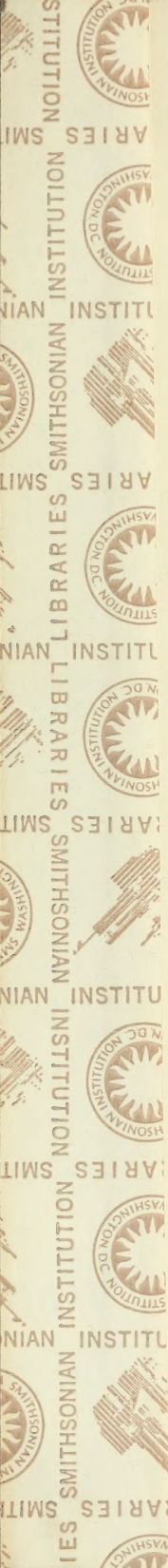
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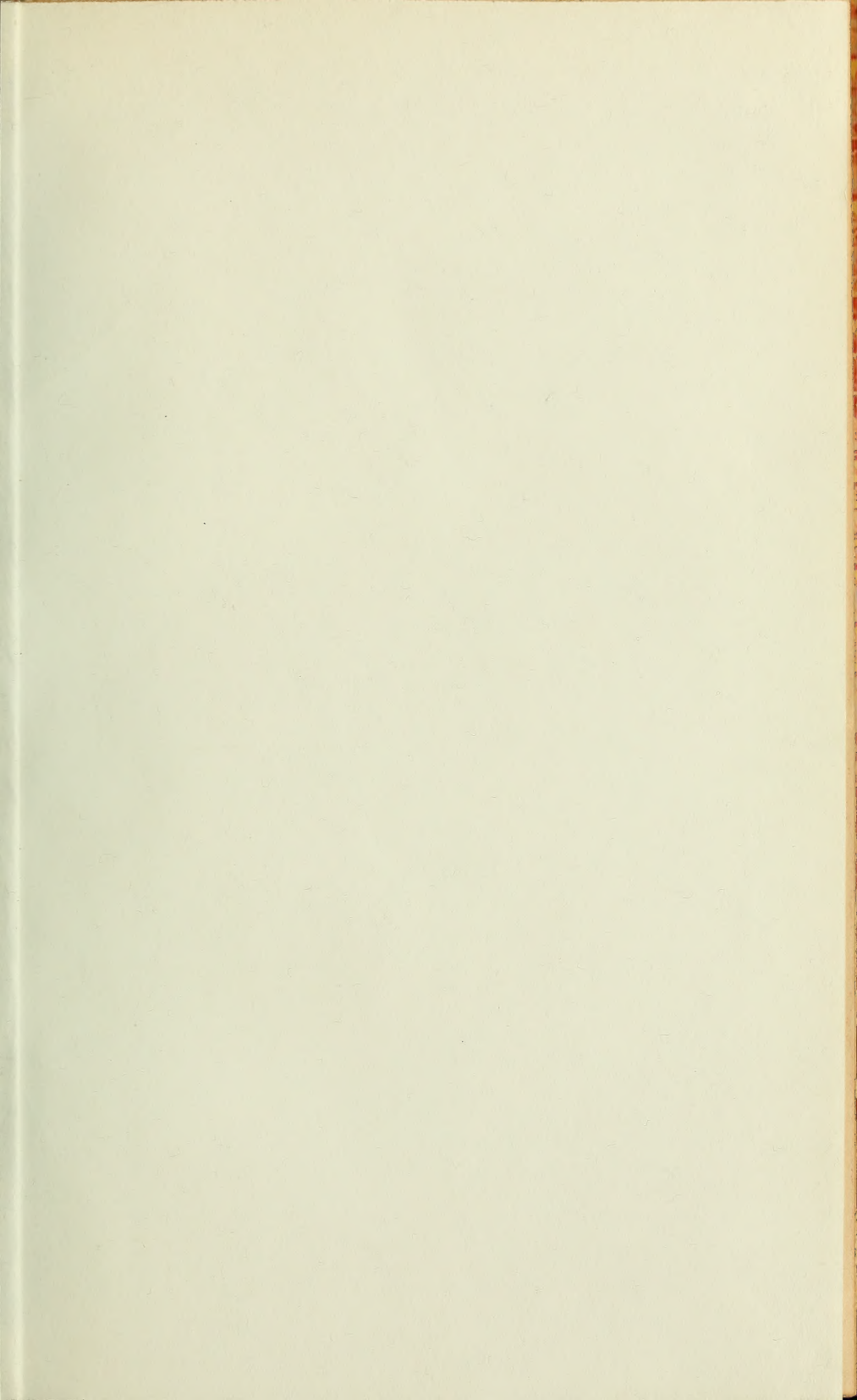
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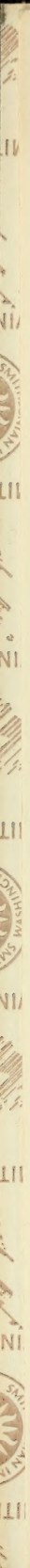












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New York State Museum

JOHN M. CLARKE, Director

Bulletin 112

ECONOMIC GEOLOGY 16

THE MINING AND QUARRY INDUSTRY

OF

NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTIONS DURING
1906

BY

D. H. NEWLAND

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MY DEAR SIR: I communicate herewith for publication as a bulletin of the State Museum, the third annual report on *The Mining and Quarry Industry of New York State* prepared by the Assistant State Geologist.

The public demand for these publications is urgent and I suggest that the printing of this report be forwarded without delay.

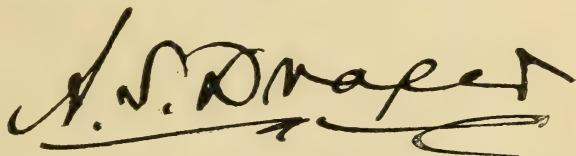
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Director

State of New York
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Approved for publication this 18th day of April 1907

A handwritten signature in dark ink, reading "A. S. Draper". The signature is fluid and cursive, with a long horizontal flourish extending to the right.

Commissioner of Education

New York State Education Department

New York State Museum

JOHN M. CLARKE, Director

Bulletin 112

ECONOMIC GEOLOGY 16

THE MINING AND QUARRY INDUSTRY

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NEW YORK STATE

REPORT OF OPERATIONS AND PRODUCTION DURING 1906

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PREFACE

The present bulletin — the third of the series to bear the same title — carries forward the plan of issuing a report each year on the mineral industry of New York. The series is intended to afford a summary of the current discoveries, developments and production of the useful mineral materials, each volume being prepared as soon after the close of the year as practicable. With this report the information is brought down to the end of 1906.

It is desired again to express grateful acknowledgment for the assistance rendered by those engaged in mining and quarry enterprises within the State; the requests for information have met with a uniform consideration on their part which has greatly facilitated the preparation of the report.

INTRODUCTION

The mineral industries of New York have continued to experience during the past year the conditions of general prosperity and advancement noticed in the previous report for 1905. A summary of the returns received from producers distributed among the different branches which are represented in the State shows a valuation for the year's output of \$37,118,430. The total takes into account over 30 mineral materials that are commercially exploited. It is to be noted, however, that the valuation is placed upon the materials in their crude or first marketable forms, and no attempt has been made to obtain information relative to the many and varied industries which derive their support from further elaboration of the materials.

The corresponding total reported in 1905 was \$35,470,987. In 1904 the value amounted to \$28,812,595. The gain for the past year was \$1,647,443 or about 5 per cent, while during the two previous years for which statistics have been collected the increase has been \$8,305,835 or nearly 30 per cent.

The progress of the iron-mining industry has been one of the notable features of the year's record. The output amounted to 905,367 long tons, the largest reported since 1891, and an increase of 78,318 tons over that for 1905. There were 11 mines in the State under exploitation, the number including three which began production during the year. Exploratory developments have been carried on by several additional companies as a preliminary to active mining. The Fair Haven Iron Co. will begin shipments in the spring from its mine situated at Sterling Station, Cayuga co. The Benson mines in St Lawrence county, the Cheever mine in Essex county and the Salisbury mine in Herkimer county have been under development. The opening of the Lake Sanford titaniferous magnetite deposits, which have recently been transferred to new ownership, is perhaps the most important prospective feature to be recorded in the mining of iron ore.

The manufacture of clay products contributed an aggregate value of \$13,955,300 in 1906 as compared with \$14,280,016 in the preceding year. The decrease was due principally to the lower prices obtained for structural materials. The output of clay building materials (brick, tile, fireproofing and terra cotta) was valued at \$11,063,433. The number of brick made was 1,600,059,000, of which 1,230,692,000 was reported by the plants along the Hudson river. Pottery is a growing branch of the clay-working industry;

its share in the total last year amounted to \$1,795,008 represented mostly by the finer wares, porcelain and semiporcelain. There were 265 clay-working plants in operation distributed among 48 counties.

There was little change in the valuation of the products reported by the quarries, the total for 1906 amounting to \$6,504,165 against \$6,107,147 in the preceding year. The sum was divided according to the various uses into: building stone \$1,408,583; monumental stone \$103,219; curbing and flagging \$999,678; crushed stone \$2,435,493; other uses \$1,557,192. The output of slate and of limestone used in making Portland and natural cements is not included in the totals.

The plants manufacturing hydraulic cement reported a production of 4,114,939 barrels, consisting of 2,423,374 barrels of Portland cement and 1,691,565 barrels of natural rock cement. There was a large falling off in the natural rock cement, owing to conditions that have developed generally in the cement trade, and for the first time the total was exceeded by that of Portland cement. The combined value of the production was \$3,950,699. In 1905 the output amounted to 4,375,520 barrels valued at \$3,673,553.

In the salt industry the production has been maintained at an unusually high rate. The total of rock and brine salt reported was 9,013,993 barrels, which is the largest on record. The output for the preceding year amounted to 8,575,649 barrels. There was a slight decrease in the market value—\$2,131,650, as compared with \$2,303,067 in 1905. A large portion of the brine salt made in New York is used for the manufacture of soda products.

The mines and quarries of gypsum made an output of 262,581 short tons, valued at \$685,053. There was a large gain over the previous year when the production amounted to 191,860 tons, valued at \$551,193. The increase came mostly from the companies manufacturing wall plaster and plaster of paris.

The combined value of the petroleum and natural gas produced in the State was \$2,487,674, against \$2,173,931 in 1905. The quantity of petroleum reported was 1,043,088 barrels valued at \$1,721,095, or a little more than in the preceding year. The natural gas industry continues to show progress, due to the active developments in Erie and Chautauqua counties. The quantity of gas reported last year was 3,007,086,000 cubic feet, against 2,639,130,000 cubic feet, the total for 1905.

Among the smaller industries which have a firm foothold in New York State are the mining of garnet, graphite and talc. The garnet

product in 1906 amounted to 4729 short tons, valued at \$159,298. The graphite produced was 2,811,582 pounds, valued at \$96,084. The talc mines reported an output of 64,200 short tons, with a valuation of \$541,600.

Mineral production of New York in 1904

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement.....	Barrels.....	1 377 302	\$1 245 778
Natural rock cement.....	Barrels.....	1 881 630	1 207 883
Building brick.....	Thousands.....	1 293 538	7 473 122
Pottery.....	.....	.....	1 438 634
Other clay products.....	.....	.....	2 592 948
Crude clay.....	Short tons.....	8 959	17 164
Emery.....	Short tons.....	1 148	17 220
Feldspar and quartz.....	Long tons.....	8 703	28 463
Garnet.....	Short tons.....	3 045	104 325
Glass sand.....	Short tons.....	11 080	8 484
Graphite.....	Pounds.....	3 132 927	119 509
Gypsum.....	Short tons.....	151 455	424 975
Iron ore.....	Long tons.....	619 103	1 328 894
Millstones.....	.....	.....	21 476
Metallic paint.....	Short tons.....	4 740	55 768
Slate pigment.....	Short tons.....	3 132	23 876
Mineral waters.....	Gallons.....	8 000 000	1 000 000
Natural gas.....	1000 cubic feet..	2 399 987	552 197
Petroleum.....	Barrels.....	1 036 179	1 709 770
Pyrite.....	Long tons.....	5 275	20 820
Salt.....	Barrels.....	8 724 768	2 102 748
Roofing slate.....	Squares.....	18 090	86 159
Slate manufactures.....	.....	.....	7 441
Granite.....	.....	.....	221 882
Limestone.....	.....	.....	2 104 095
Marble.....	.....	.....	478 771
Sandstone.....	.....	.....	1 896 697
Trap.....	.....	.....	468 496
Talc.....	Short tons.....	65 000	455 000
Other materials ^a.....	.....	.....	1 600 000
Total value.....	.....	.....	\$28 812 595

^a Includes apatite, carbon dioxide, diatomaceous earth, fullers earth, marl and sand. The value is partly estimated.

Mineral production of New York in 1905

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement.....	Barrels.....	2 117 822	\$2 046 864
Natural rock cement.....	Barrels.....	2 257 698	1 590 689
Building brick.....	Thousands.....	1 512 157	10 054 597
Pottery.....	.....	.....	1 620 558
Other clay products.....	.....	.....	2 603 861
Crude clay.....	Short tons.....	6 766	16 616
Emery.....	Short tons.....	1 475	12 452
Feldspar and quartz.....	Long tons.....	17 000	48 500
Garnet.....	Short tons.....	2 700	94 500
Glass sand.....	Short tons.....	9 850	7 765
Graphite.....	Pounds.....	3 897 616	142 948
Gypsum.....	Short tons.....	191 860	551 193
Iron ore.....	Long tons.....	827 049	2 576 123
Millstones.....	.....	.....	22 944
Metallic paint.....	Short tons.....	6 059	70 090
Slate pigment.....	Short tons.....	2 929	22 668
Mineral waters.....	Gallons.....	8 000 000	1 000 000
Natural gas.....	1000 cubic feet..	2 639 130	607 000
Petroleum.....	Barrels.....	949 511	1 566 931
Pyrite.....	Long tons.....	10 100	40 465
Salt.....	Barrels.....	8 575 649	2 303 067
Roofing slate.....	Squares.....	16 460	94 009
Slate manufactures.....	.....	.....	1 000
Granite.....	.....	.....	253 955
Limestone.....	.....	.....	2 411 456
Marble.....	.....	.....	774 557
Sandstone.....	.....	.....	2 043 960
Trap.....	.....	.....	623 219
Talc.....	Short tons.....	67 000	469 000
Other materials ^a.....	.....	.....	1 800 000
Total value.....	.....	.....	\$35 470 987

^a Includes apatite, carbon dioxide, diatomaceous earth, fullers earth, marl, sand and sand lime brick. The value is partly estimated.

Mineral production of New York in 1906

PRODUCT	UNIT OF MEASUREMENT	QUANTITY	VALUE
Portland cement.....	Barrels.....	2 423 374	\$2 766 488
Natural rock cement.....	Barrels.....	1 691 565	1 184 211
Building brick.....	Thousands.....	1 600 059	9 688 289
Pottery.....	.....	.....	1 795 008
Other clay products.....	.....	.....	2 472 003
Crude clay.....	Short tons.....	5 477	9 125
Emery.....	Short tons.....	1 307	13 870
Feldspar and quartz.....	Long tons.....	13 660	44 350
Garnet.....	Short tons.....	4 729	159 208
Glass sand.....	Short tons.....	9 000	8 600
Graphite.....	Pounds.....	2 811 582	96 084
Gypsum.....	Short tons.....	262 581	685 053
Iron ore.....	Long tons.....	905 367	3 393 609
Millstones.....	.....	.....	22 442
Metallic paint.....	Short tons.....	2 714	29 140
Slate pigment.....	Short tons.....	2 045	15 960
Mineral waters.....	Gallons.....	8 000 000	1 000 000
Natural gas.....	1000 cubic feet..	3 007 086	766 579
Petroleum.....	Barrels.....	1 043 088	1 721 095
Pyrite.....	Long tons.....	11 798	35 550
Salt.....	Barrels.....	9 013 993	2 131 650
Roofing slate.....	Squares.....	16 248	57 771
Slate manufactures.....	.....	.....	4 150
Sand lime brick.....	Thousands.....	17 080	122 340
Granite.....	.....	.....	255 189
Limestone.....	.....	.....	2 963 829
Marble.....	.....	.....	460 915
Sandstone.....	.....	.....	1 976 829
Trap.....	.....	.....	847 403
Talc.....	Short tons.....	64 200	541 600
Other materials.....	.....	.....	1 850 000
Total value.....	.....	.....	\$37 118 430

^a Includes apatite, arsenical ore, carbon dioxide, diatomaceous earth, fullers earth, marl, and sand and gravel exclusive of glass sand.

ARSENICAL ORE

Several hundred tons of arsenical ore were mined in New York State last year. A part of the output was sold to reduction works for manufacture into arsenical compounds. Though deposits of this ore have been worked previously in the State, it is probably the first time that they have supplied any commercial product.

The ores known to occur in New York include arsenopyrite, leucopyrite and scorodite. The first named, a sulfarsenid of iron with 46% arsenic, is the most abundant. It is also the principal variety employed in the trade. It occurs in Orange, Putnam and Essex counties, in veins which intersect the older crystalline rocks.

The deposit which has been under operation during 1906, is situated near Pine pond, town of Kent, Putnam co. It has been known for many years and was the object of exploration as early as 1847. The operations were abandoned, however, after a little preliminary work. In 1888 a small quantity of ore was mined and shipped to New Jersey, evidently for other purposes than the utilization of the arsenic as no plant for treating the ore is located in that state. The present company, the Putnam County Mining Corporation, undertook the development of the property in April, 1906. Of the ore that has been mined, a portion amounting to a few hundred tons was found to contain sufficient arsenic to be shipped in crude condition and was sold to metallurgical establishments abroad. The low grade ore has been held in stock with a view to future concentration, for which a special plant will have to be built.

So far as revealed by existing developments, the deposit appears to be a vein-intersecting gneiss which is the prevailing formation in this section and includes both igneous and sedimentary varieties. The vein lies near the base of a prominent ridge, southwest of Pine pond. It has a northerly strike. In close proximity and running parallel is a dike of basic rock, the outcropping portion of which is completely changed to serpentine. The dike rises above the surface as a distinct ridge that can be traced for half a mile or more along the strike and shows a width of from 100 to 300 yards. It is probably a peridotite, though the nature of the original components can only be inferred from the general appearance and texture.

The vein consists of white flinty quartz with varying proportions of arsenopyrite and pyrite. In places the metallic minerals occur in solid mass, but usually they are distributed through the quartz. Pyrite is much less abundant of the two, its distribution being very irregular. Both are seldom crystallized. The percentage of metallic arsenic in the ore ranges nearly up to the theoretical amount required by the chemical formula. With hand sorting a fairly large proportion will assay above 25% which is considered marketable grade. For the following complete analysis of the ore the writer is indebted to Mr George Wishart, manager of the mine.

Silica (SiO_2)	2.90
Iron (Fe)	36.11
Copper (Cu)	2.17
Sulfur (S)	22.72
Arsenic (As)	36.00

99.90

The copper shown by the analysis is probably present in the pyrite. This mineral usually has the deep yellow color characteristic of the copper-bearing variety.

An analysis of the dike, which has also been reported by Mr Wishart, is sufficiently interesting to deserve record. It establishes the ultra-basic nature of the rock and is in agreement with the view above expressed that it is an altered peridotite.

Silica (SiO_2)	35.50
Alumina (Al_2O_3)	4.52
Ferric oxid (Fe_2O_3)	7.40
Lime (CaO)	2.60
Magnesia (MgO)	37.64
Carbon dioxid (CO_2)	13.30
Water (H_2O)	
	100.96

Arsenopyrite has been reported by Beck¹ and Whitlock² near Edenville and at other places in Orange county and in the town of Lewis, Essex co., 10 miles south of Keeseville. At the first named locality it is associated with leucopyrite, the disarsenid of iron and scorodite, a hydrous arsenate of iron; the wall rock is crystalline limestone.

CARBON DIOXID

The production of natural carbonic acid gas as an industry is confined to the vicinity of Saratoga Springs. There are no other localities in this country where the gas is recovered from natural sources and marketed, though a large production is made by the decomposition of mineral carbonates, combustion of coke and in other ways.

The companies engaged in this industry at Saratoga Springs include the following: New York Carbonic Acid Gas Co., Natural Carbonic Gas Co., Lincoln Spring Co., Geysers Natural Carbonic Acid Gas Co., and the Champion Natural Carbonic Acid Gas Co.

The phenomena of occurrence and the methods used in collecting and storage of the gas for market have been described in the preceding issue of this publication. There have been no new features in the industry during the past year, except that the production

¹ Mineralogy of New York. 1842.

² List of New York Mineral Localities, N. Y. State Mus. Bul. 70. 1903.

has increased about 25 per cent. According to an estimate made by J. C. Minor jr, the quantity recovered was about 5,000,000 pounds, compared with 4,000,000 pounds in 1905. The gain has been due rather to the perfection of the methods for saving the gas than to drilling of additional wells.

CEMENT

The conditions in the cement industry were, on the whole, very favorable during the past year. There was an unusual demand for cement within the State, due to the general activity of building and construction and specially to the carrying out of important engineering undertakings in connection with the canal system and the railroad terminals of New York city. As a consequence the companies were able to market their entire output for the year without difficulty. The prices have also been higher than for some time past.

In all there were 19 firms that reported a production in 1906, as compared with 21 firms similarly reporting in the previous year. The combined output of Portland and natural rock cement amounted to 4,114,939 barrels valued at \$3,950,699. In 1905 the output was 4,375,520 barrels valued at \$3,673,553, so that there was a loss for the year of 260,581 barrels in the quantity produced, but a gain of \$277,196 in the value. The decreased production was brought about by the conditions incidental to the natural rock cement trade which has lost a good deal of its former importance in this State as elsewhere.

The output of Portland cement amounted to 2,423,374 barrels valued at \$2,766,488 against 2,117,822 barrels valued at \$2,046,864 in 1905. There were 10 companies in operation, a gain of one for the year. The Cummings Cement Co., at Akron, Erie co., which had closed down its plant for repairs and new machinery, was again productive. The company makes both Portland and natural rock cement. Important improvements have been made in the plant of the Glens Falls Cement Co., including the installation of rotary kilns in the place of upright kilns.

The production of natural rock cement amounted to 1,691,565 barrels valued at \$1,184,211. In 1905 the total was 2,257,698 barrels valued at \$1,590,689. As heretofore the Rosendale district has contributed most of the output, its share having been 1,514,336 barrels with a value of \$1,107,535. In 1905 this district produced 1,977,698 barrels valued at \$1,472,489. Onondaga county reported a total of 63,043 barrels valued at \$30,923, against 77,000 barrels

valued at \$31,500 in the previous year. The remainder of the output came from Erie county. In all there were nine plants active, or three less than in 1905. The Buffalo Cement Co., of Buffalo and the Potter-Brown Cement Works at Manlius, Onondaga co., were inoperative and will probably not resume the manufacture of natural rock cement. The Akron Cement Works also suspended operations.

Production of cement in New York

YEAR	PORTLAND CEMENT		NATURAL CEMENT	
	Barrels	Value	Barrels	Value
1890.....	65 000	\$140 000	3 776 756	\$2 985 513
1891.....	87 000	190 250	3 931 306	3 046 279
1892.....	124 000	279 000	3 780 687	3 074 781
1893.....	137 096	287 725	3 597 758	2 805 387
1894.....	117 275	205 231	3 446 330	1 974 463
1895.....	159 320	278 810	3 939 727	2 285 094
1896.....	260 787	443 175	4 181 918	2 423 891
1897.....	394 398	690 179	4 259 186	2 123 771
1898.....	554 358	970 126	4 157 917	2 065 658
1899.....	472 386	708 579	4 689 167	2 813 500
1900.....	465 832	582 290	3 409 085	2 045 451
1901.....	617 228	617 228	2 234 131	1 117 066
1902.....	1 156 807	1 521 553	3 577 340	2 135 036
1903.....	1 602 946	2 031 310	2 417 137	1 510 529
1904.....	1 377 302	1 245 778	1 881 630	1 207 883
1905.....	2 117 822	2 046 864	2 257 698	1 590 689
1906.....	2 423 374	2 766 488	1 691 565	1 184 211

CLAY

The manufacture of brick and other clay products is the most important branch of the mineral industry in New York. Clay deposits suitable for making the common wares are distributed throughout every section in practically inexhaustible quantities. The rapidly growing market for these products has led to the establishment of numerous manufacturing plants in recent years, so that now there is scarcely an industrial center of any size in which they are not produced. This is particularly true with regard to the manufacture of building materials, which are being employed more and more widely as an element in permanent construction. Owing to their cheapness, durability and the convenience with which they can be adapted to meet the varied architectural requirements, the use of these materials will doubtless continue to expand for a long time to come.

The manufacture of the finer grades of clay wares has not developed so rapidly as the other lines. In contrast with most of the states along the Atlantic seaboard, New York possesses almost no deposits of kaolin in quantity to be of economic value. This fact has hitherto retarded the establishment of industries in which kaolin is employed, but with improved facilities of transport, the deficiency has become less formidable to local manufacturers. There are now several plants in the State making tableware, electrical supplies and other porcelain and semiporcelain wares.

Production of clay materials

The unprecedented demand for clay building materials which was experienced in nearly all sections of the State throughout the previous year, continued to exert a favorable influence on the clay-working industries during 1906. For the first part of the year the output of building brick was specially large. Under the stimulus of the high prices received during 1905, a number of new plants were placed in operation, while many of the old ones were improved and enlarged, resulting in a considerable increase of the aggregate capacity. During the first few months of the year the demand was sufficient to absorb the entire output, but before the summer was well advanced a gradual slackening of building operations began to be felt in the large cities and became more pronounced toward the end of the season. With the falling off in the demand, manufacturers cut down their production to some extent so that their average for the year was about on the same scale as in 1905.

The aggregate value of the production of clay materials of all kinds for 1906 was \$13,955,300. There were 265 companies or individuals actively engaged in the industry, as compared with 250 in the preceding year. Of the 61 counties of the State, 48 were represented in the returns as having an output of clay materials. Compared with the production of 1905, which was valued at \$14,280,016, there was a decrease of \$324,716, or about 2 per cent. The falling off in the valuation of building brick alone more than equalled the aggregate decline.

The value of the output of common building brick for the year amounted to \$9,302,165, as compared with \$9,751,753 in 1905. Front brick and fancy building brick aggregated \$386,124, as compared with \$302,844; vitrified paving brick \$178,011, against \$180,004; and fire brick and stove lining \$527,659, against \$498,184 in the preceding year. The manufacture of drain tile amounted to

\$166,645 against \$146,790; and sewer pipe to \$95,142, against \$444,-457. The product of terra cotta was valued at \$1,037,387, as compared with \$874,717 in 1905; fireproofing at \$120,282, as compared with \$133,995; and building tile at \$217,475, as compared with \$251,600. In addition there were produced miscellaneous materials, including flue lining, fire tile and shapes, conduit pipes, sidewalk brick and acid-proof brick, the collected value of which amounted to \$129,402, against \$74,114 in 1905. The potteries of the State reported an output valued at \$1,795,008, as compared with a value of \$1,620,558 in the preceding year.

Production of clay materials

MATERIAL	1904	1905	1906
Common brick.....	\$7 234 876	\$9 751 753	\$9 302 165
Front brick.....	238 246	302 844	386 124
Vitrified paving brick.....	210 707	180 004	178 011
Fire brick and stove lining....	506 800	498 184	527 659
Drain tile.....	149 864	146 790	166 645
Sewer pipe.....	460 000	444 457	95 142
Terra cotta.....	798 028	874 717	1 037 387
Fireproofing.....	157 119	133 995	120 282
Building tile.....	206 503	251 600	217 475
Miscellaneous.....	103 927	75 114	129 402
Pottery.....	1 438 634	1 620 558	1 795 008
Total.....	\$11 504 704	\$14 280 016	\$13 955 300

The distribution of the production according to the counties in which it was made shows that Rockland county has the largest clay-working industry. The value of its output in 1906 was \$1,767,012. It also led the list of counties in 1905 with an aggregate value of \$2,144,210. Ulster county ranks second in importance, its total being \$1,465,457, as compared with \$1,776,035 in the preceding year. Orange county, which was fourth in 1905, advanced to third place last year with a total of \$1,170,695, against \$1,011,006. Onondaga county ranks fourth with a value of \$1,094,635, against \$932,285, the greater part of its production being pottery. Dutchess county moved from third place in 1905, when it reported a value of \$1,258,-937, to fifth in 1906, with a valuation of \$975,410. The other counties that reported a production valued at \$100,000 or over in 1906 are: Richmond (\$896,789); Erie (\$804,159); Albany (\$675,099); Kings (\$575,973); Westchester (\$536,189); Columbia

(\$489,750); Greene (\$399,298); Saratoga (\$388,450); Ontario (\$343,040); Monroe (\$341,870); Rensselaer (\$296,762); Steuben (\$209,052); Nassau (\$163,700); Suffolk (\$138,500); Allegany (\$111,683); Oneida (\$103,263); and Queens county, the total of which is withheld in order not to reveal the figures reported by the single producer.

Production of clay materials by counties

COUNTY	1904	1905	1906
Albany.....	\$648 973	\$624 238	\$675 099
Allegany.....	127 552	118 989	111 683
Broome.....	22 000	18 000	12 000
Cayuga.....	24 520	25 920	17 860
Chautauqua.....	83 405	78 130	99 085
Chemung.....	96 300	96 000	90 000
Clinton.....	5 000	5 900	4 800
Columbia.....	420 500	520 500	489 750
Dutchess.....	932 907	1 258 937	975 410
Erie.....	647 334	700 527	804 159
Fulton.....	4 000	1 700	2 600
Greene.....	232 924	389 562	399 298
Jefferson.....	30 467	36 502	36 722
Kings.....	539 288	565 888	575 973
Madison.....	16 400	12 000	16 800
Monroe.....	658 058	644 411	341 870
Nassau.....	52 644	76 992	163 700
Niagara.....	16 892	3 272	10 832
Oneida.....	145 880	133 250	103 263
Onondaga.....	916 954	932 285	1 094 635
Ontario.....	245 743	345 250	343 040
Orange.....	690 064	1 011 006	1 170 695
Rensselaer.....	257 751	263 256	296 762
Richmond.....	488 873	645 367	896 789
Rockland.....	1 422 436	2 144 210	1 767 012
Saratoga.....	331 360	362 268	388 450
Seneca.....	19 175	3 525	39 525
Steuben.....	176 613	164 663	209 052
Suffolk.....	86 112	113 000	138 500
Tompkins.....	17 715	15 004	a.....
Ulster.....	1 274 284	1 776 035	1 465 457
Warren.....	28 625	45 712	34 500
Washington.....	15 755	20 270	22 033
Westchester.....	354 705	592 705	536 189
Other counties ^b	473 495	534 742	621 757
Total.....	\$11 504 704	\$14 280 016	\$13 955 300

^aIncluded under "other counties."

^bIncludes in 1905: Genesee, Montgomery, New York, Queens, St Lawrence, Schenectady, Wayne and Wyoming counties. In 1906 the following counties are included: Cattaraugus, Genesee, Herkimer, Livingston, Montgomery, New York, Queens, St Lawrence, Schenectady, Tioga, Tompkins and Wayne.

Manufacture of building brick

The output of common building brick in 1906 amounted to 1,575,-434,000, valued at \$9,302,165. In addition there were made 24,-625,000 front and fancy pressed brick, valued at \$386,124; making an aggregate output of brick for building purposes of 1,600,059,000, valued at \$9,688,289. The total quantity manufactured in the preceding year was 1,512,157,000, valued at \$10,054,597, consisting of

Production of common building brick

COUNTY	1905		1906	
	Number	Value	Number	Value
Albany.....	66 500 000	\$439 238	74 083 000	\$461 399
Allegany.....	1 092 000	6 957	a.....	a.....
Broome.....	3 000 000	18 000	2 000 000	12 000
Cayuga.....	3 416 000	21 520	2 215 000	13 310
Chautauqua.....	8 885 000	49 992	8 567 000	52 031
Chemung.....	15 600 000	96 000	15 000 000	90 000
Clinton.....	1 100 000	5 900	800 000	4 800
Columbia.....	84 750 000	520 500	84 500 000	489 750
Dutchess.....	181 683 000	1 258 937	167 132 000	975 410
Erie.....	54 269 000	282 859	56 302 000	319 365
Greene.....	55 719 000	377 470	64 690 000	390 748
Jefferson.....	4 900 000	36 502	5 100 000	36 722
Monroe.....	24 176 000	139 320	26 077 000	158 463
Nassau.....	8 240 000	58 872	22 000 000	125 000
Niagara.....	a.....	a.....	2 172 000	10 832
Oneida.....	17 046 000	86 769	20 550 000	100 825
Onondaga.....	16 889 000	104 134	22 387 000	127 494
Ontario.....	3 000 000	18 000	3 510 000	21 700
Orange.....	160 530 000	1 011 006	189 180 000	1 170 695
Rensselaer.....	25 250 000	133 350	31 776 000	173 906
Richmond.....	a.....	a.....	34 769 000	172 880
Rockland.....	302 625 000	2 144 210	296 145 000	1 767 012
St Lawrence.....	600 000	4 200	a.....	a.....
Saratoga.....	62 335 000	319 569	70 509 000	385 950
Seneca.....	50 000	400	6 050 000	36 400
Steuben.....	2 000 000	21 300	4 705 000	31 800
Suffolk.....	17 250 000	110 000	21 710 000	137 500
Tompkins.....	2 021 000	15 004	a.....	a.....
Ulster.....	265 368 000	1 776 035	252 665 000	1 465 457
Warren.....	8 763 000	45 712	a.....	a.....
Washington.....	2 300 000	11 800	3 300 000	18 100
Westchester.....	76 893 000	530 465	70 621 000	458 000
Other countiesb...	17 209 000	107 732	16 919 000	94 606
Total.....	1 493 459 000	\$9 751 753	1 575 434 000	\$9 302 165

a Included under "other counties."

b Includes in 1905 the following: Fulton, Herkimer, Livingston, Montgomery, Richmond, Tioga and Wyoming. In 1906 the following counties are included: Allegany, Cattaraugus, Fulton, Herkimer, Livingston, Montgomery, St Lawrence, Schenectady, Tioga, Tompkins and Warren.

1,493,459,000 common brick, valued at \$9,751,753 and 18,698,000 front and fancy bricks valued at \$302,844. The manufacture of these materials was carried on in 37 counties by a total of 213 companies or individuals. In 1905 there were 39 counties represented with a total of 192 plants.

The average price received for common brick last year was \$5.98 a thousand, as compared with \$6.53 a thousand in 1905 and \$5.67 a thousand the average for 1904. Front and fancy pressed brick averaged \$15.68 a thousand against \$16.20 in 1905 and \$13.48 in 1904.

Hudson river region. The counties in New York State situated along the Hudson river are specially favored in respect to the manufacture of building brick. New York city and vicinity, with its rapidly increasing population, is by far the greatest market for such materials in the United States. There exist enormous clay deposits, suitable for making the common grades of brick, on either side of the river from Rensselaer and Albany counties down to Rockland and Westchester, while the river itself affords a convenient and cheap means of transportation direct from the yards to the market. As a result of these conditions the brick industry of this section has developed to proportions that are without parallel in any other part of the country.

In 1906 the output of common brick in the Hudson river region amounted to a total of 1,230,692,000. This is approximately 78 per cent of the whole output of common brick in the State. The value of the production was \$7,352,377. In the preceding year the output was 1,219,318,000, valued at \$8,191,211. There was thus a gain of 11,374,000 in quantity, but a loss of \$838,834 in value. The number of companies reporting as active was 131, an increase of 12 for the year, or 20 more than in 1904. Rockland county was represented by the largest number, 33, and its production amounted to 296,145,000, valued at \$1,767,012. Ulster county, with 26 operative companies, produced 252,665,000, valued at \$1,465,457; and Orange county made 189,180,000, valued at \$1,170,695, reported by 12 companies.

The average number of brick made in each plant in 1906 was 9,471,000, as compared with 10,246,000 in 1905 and 9,180,000 in 1904. The price for the whole region averaged during the year \$5.98 a thousand against \$6.54 a thousand for 1905 and \$5.79 a thousand for 1904.

The main feature of the past year's record was the remarkable range in the market prices received for brick in the New York

market. Owing to the great building activity that prevailed during 1905, the whole product of that year was practically disposed of by the close of the brick-making season, and the plants carried little or no stock through the winter. Before the opening of the yards in the spring of 1906 there was a veritable brick famine. Prices reached an unprecedented high level; as much as \$10 and

Output of common brick in the Hudson river region in 1905

COUNTY	NUMBER OF PLANTS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany.....	8	66 500 000	\$439 238	\$6 61
Columbia.....	5	84 750 000	520 500	6 09
Dutchess.....	17	181 683 000	1 258 937	6 93
Greene.....	7	55 719 000	377 470	6 77
Orange.....	12	160 530 000	1 011 006	6 67
Rensselaer.....	8	25 250 000	133 350	5 28
Rockland.....	31	302 625 000	2 144 210	7 08
Ulster.....	23	265 368 000	1 776 035	6 69
Westchester.....	8	76 893 000	530 465	6 90
Total.....	119	1 219 318 000	\$8 191 211	\$6 54

Output of common brick in the Hudson river region in 1906

COUNTY	NUMBER OF PLANTS	OUTPUT	VALUE	AVERAGE PRICE PER M
Albany.....	11	74 083 000	\$461 399	\$6 23
Columbia.....	6	84 500 000	489 750	5 80
Dutchess.....	19	167 132 000	975 410	5 82
Greene.....	6	64 600 000	390 748	6 04
Orange.....	12	189 180 000	1 170 695	6 19
Rensselaer.....	9	31 776 000	173 906	5 48
Rockland.....	33	296 145 000	1 767 012	5 97
Ulster.....	26	252 665 000	1 465 457	5 80
Westchester.....	9	70 621 000	458 000	6 46
Total.....	131	1 230 692 000	\$7 352 377	\$5 98

even \$12 a thousand was paid for the available supply. With the resumption of manufacture they rapidly fell to \$8 or \$9, and as the season advanced they continued to decline due to a slackening in building operations. As the plants had been brought up

to their highest efficiency in anticipation of a profitable season, there were also unusually large quantities offered upon the market. In the last months of the season, the prices fell to about \$5 a thousand at the yard and held at that level throughout the remainder of the year, with small demand. At the end of the year the stock held by the companies along the river was probably in excess of 300,000,000, or fully 25 per cent of the whole output. A radical curtailment of operations is to be expected for the current season.

Other clay materials

The manufacture of paving brick was carried on during 1906 in Chautauqua, Greene, Onondaga and Steuben counties. There were five companies engaged in the business and the output was 11,472,000, valued at \$178,011. In 1905 there were six companies which reported a production of 13,984,000, valued at \$180,004.

Fire brick and stove lining were manufactured in Albany, Chautauqua, Erie, Kings, Onondaga, Rensselaer, Richmond, Schenectady, Washington and Westchester counties by a total of 13 companies. The output of fire brick amounted to 12,091,413, valued at \$413,147, and the stove lining was valued at \$114,512, a combined value of \$527,659. In 1905 the value of the two materials was \$498,184 reported by 13 companies.

Drain tile and sewer pipe were made in Albany, Cayuga, Chautauqua, Erie, Genesee, Kings, Madison, Monroe, Oneida, Onondaga, Ontario, Saratoga, Seneca, Washington and Wayne counties. The output of drain tile was valued at \$166,645, against \$146,790 in 1905; and sewer pipe at \$95,142, against \$444,457. There were 26 companies engaged in this branch of the industry, a gain of two as compared with the previous year.

Terra cotta, fireproofing and building tile were produced in Albany, Allegany, Chautauqua, Erie, Genesee, Kings, Monroe, Onondaga, Ontario, Queens, Rensselaer, Richmond and Steuben counties, by a total of 17 companies, or three less than in 1905. The production of terra cotta was valued at \$1,037,387, against \$874,717 in 1905; fireproofing at \$120,282, against \$133,395; and building tile at \$217,475, against \$251,600.

New manufacturers of clay materials

The following list includes the names of the companies or individuals who have erected plants during the past year, or have taken over old plants, for the manufacture of clay structural materials. The list is supplementary to the one published in the report for 1905.

NAME	LOCATION OF PLANT
Albany co.	
Corwin & McCullough	Coeymans
Powell & Minnock	Coeymans
C. A. Smith	Albany
Edward J. Smith & Co.	Albany
Ziegler & Ziegler	Coeymans
Dutchess co.	
Harlem Valley Brick & Supply Co.	Amenia
John Nicholson	Dutchess Junction
Herkimer co.	
Staley & Co.	Ilion
Orange co.	
George W. Hunt	Chelsea
Rensselaer co.	
Palmer Bros.	Troy
Rensselaer Brick Co.	Rensselaer
G. L. Tobin	Castleton
Richmond co.	
Rossville Brick Co.	Rossville
Rockland co.	
Lynch & O'Brien	Haverstraw
Reilly & Marks	Stony Point
West Haverstraw Brick Co.	West Haverstraw
Schenectady co.	
Cady & Vandenberg	Schenectady
Electric City Clay Brick Co.	Glenville
Suffolk co.	
The Brown Clay Works	Fort Salonga
Ulster co.	
Lowe Brick Co.	New Paltz
Estate of A. S. Staples	Port Ewen
Ulster Brick Co.	Saugerties
W. M. Burhans, Executor	Saugerties

Pottery

The manufacture of pottery has become an important branch of the clay-working industry of the State. Its development, however, has been due rather to the exceptional facilities afforded by the State for manufacturing and marketing the products than to the existence of natural resources of crude materials that are employed in the potteries. With the exception of the deposits of slip clay in Albany county and a limited supply of stoneware clays in Onondaga county, the raw materials are derived entirely from

without the State. The kaolin used comes from New Jersey and from England, the feldspar from Canada, and much of the pottery clay from New Jersey.

In the accompanying table is shown the value of the pottery manufactures during the past three years. The total valuation of the product for 1906, as returned by the individual plants, was \$1,795,008. The preceding year's output was valued at \$1,620,558 and that of 1904 at \$1,438,634. The growth of the industry during the period has been brought about by the increased production of the high grade products—porcelain and semiporcelain tablewares and electric and sanitary supplies. The manufacture of stoneware and earthenware has remained almost stationary. The products listed in the table under "Miscellaneous" include yellow and Rockingham wares, clay tobacco pipes, fire clay crucibles and artistic pottery.

There were 22 potteries that reported as active in 1906, the same number as in the two preceding years. They were distributed among the following counties: Albany, Chautauqua, Erie, Kings, Madison, Monroe, Nassau, Onondaga, Ontario, Schenectady, Suffolk, Washington and Wayne. Onondaga holds first place in point of production, with a total for 1906 valued at \$858,270, as compared with \$718,985 in 1905 and \$673,590 in 1904. Kings county is the second largest producer, contributing an output valued at \$306,105, against \$308,443 in the preceding year and \$279,009 in 1904.

The Rochester City Pottery of Rochester making earthenware and the Van Der Meulen & Wylstra Art Pottery Co., of Dunkirk, making delft reported an output in 1906 for the first time.

Value of production of pottery

WARE	1904	1905	1906
Stoneware.....	\$77 726	\$115 890	\$84 031
Red earthenware.....	44 990	30 740	30 234
a Porcelain and semiporcelain....	740 000	800 000	835 000
Electric and sanitary supplies....	490 095	600 325	768 236
Miscellaneous.....	85 823	73 603	77 507
Total.....	\$1 438 634	\$1 620 558	\$1 795 008

a Includes china tableware.

Crude clay

In the foregoing tables relating to clay products no account has been taken of the crude clay entering into their manufacture. There are a few producers in the State who do not utilize the crude clay themselves, but ship their output to others for manufacture. Some of the material, like the Albany slip clay for example, is even forwarded to points without the State. In 1906, returns were received from four firms engaged in this industry whose total shipments amounted to 5477 short tons valued at \$9125. The corresponding total for 1905 was 6766 tons with a value of \$16,616 and for 1904 8959 tons with a value of \$17,164.

EMERY

The emery deposits near Peekskill were worked on about the usual scale during the past year. The output reported by the four producers that were active amounted to 1307 short tons valued at \$13,870. This compares with a total of 1475 tons valued at \$12,452 in 1905 and 1148 tons with a value of \$17,220 in 1904. The valuation is based on the crude material as it comes from the quarries where it undergoes only a rough sorting before shipment. The lump emery is sent to outside points for grinding and manufacture into emery wheels, stones, cloth, etc.

The list of producers in 1906 includes the following: Blue Corundum Mining Co., Easton, Pa., Keystone Emery Mills, Frankford, Pa., J. R. Lancaster, Peekskill and the Tanite Co. Stroudsburg, Pa. The Keystone Emery Mills have taken over the properties formerly worked by H. M. Quinn. With the exception of J. R. Lancaster who sells his product to the Hampden Corundum Wheel Co., of Springfield, Mass., the companies mine the emery for their own consumption in connection with manufacturing plants.

FELDSPAR

The quarries of feldspar at Bedford, Westchester co., were operated as in previous years by P. H. Kinkel of that place and yielded their average output. In connection with the working of the quarries a considerable quantity of quartz, or flint as it is commonly termed, was obtained. The feldspar was shipped to Trenton, N. J., where it is employed in the manufacture of porcelain wares. An additional source of supply for the mineral received attention during the past year, the locality being in Washington county, about 3 miles north of Fort Ann. The feldspar is found here in

a pegmatite dike. A quarry had been opened some 20 years ago and worked for a time for the quartz which is mixed with the feldspar. Only a small quantity of feldspar was taken out in the past year. The operator of the quarry was Dominic Ashley of Glens Falls. The combined production of feldspar and quartz in New York State amounted in 1906 to 13,660 long tons valued at \$44,350. The total for the previous year was 17,000 long tons valued at \$48,500.

GARNET

Though there have been no new sources of supply for garnet, other than those described in the previous report, the mining industry has shown unusual progress during the past year. The demand for the mineral among abrasive manufacturers seems to be expanding rapidly at present.

The occurrence of garnet may be said to be quite widespread in the Adirondacks and other regions where the rock formations have a metamorphosed character. It is only seldom found, however, in deposits of sufficient size and richness and at the same time with the proper physical qualities to warrant commercial exploitation. There is little to be feared, apparently, from a possible overproduction, at least from the present mining sections.

The output from the Adirondack region has been made by three companies: the North River Garnet Co., with mines at Thirteenth lake, Warren co; H. H. Barton & Son Co., who operate the deposits on Gore mountain, near North River; and the American Glue Co., with mines on Garnet peak, north of the latter locality. The first named company has been the largest producer. Its new mill which was first started in 1905 was in continuous operation during the past year. The deposits are so situated that they can be worked through the winter. At the other localities where the garnet is obtained by open cutwork and hand sorting, operations can not be carried on to advantage in the winter months.

The newly discovered deposit near Keeseville, Essex co., noted in the report for 1905, has been under development, but made no output except a small quantity for experimental purposes. The recent work has shown the deposit to be of large extent. The garnet occurs in massive form, frequently more or less granulated and admixed with green pyroxene. It has been used experimentally in the manufacture of abrasive wheels, with results reported as very satisfactory. The property is owned by G. W. Smith of Keeseville.

The production reported by the companies for 1906 was the largest on record, amounting to 4729 short tons valued at \$159,298. In the preceding year the total was 2700 tons valued at \$94,500, and in 1904 it was 3045 tons valued at \$104,325. The relatively small output for 1905 was due in part to a temporary curtailing of operations by the North River Garnet Co., incidental to starting their new plant.

GRAPHITE

The production of crystalline graphite in the Adirondack region showed an unexpected falling off during the past year. It amounted to a total of 2,811,582 pounds valued at \$96,084, as compared with 3,897,616 pounds valued at \$142,948 in 1905 and 3,132,927 pounds valued at \$119,509 in 1904. The output for 1905 was probably the largest that has been made in any one year since the establishment of the industry. The average value of the graphite per pound was 3.4 cents in 1906, 3.7 cents in 1905 and 3.8 cents in 1904, showing that there has been a decrease also in the market prices received for the product. The relatively small output in 1906 can not be ascribed to any general conditions that are likely to influence adversely the future progress of the industry, but is doubtless a temporary feature incidental to the limited scope of the operations as carried on at present.

The Adirondack graphite deposits which are being exploited are of the bedded type, the graphite occurring as disseminated flakes in a rock matrix, which may be limestone, quartzite or a silicious schist. The rocks are ancient sediments that have been thoroughly metamorphosed, and it is believed that the graphite has originated from included organic matter that was distilled by the heat to which they have been subjected, with a resultant loss of the volatile constituents. The rocks which have a thoroughly crystalline character, occur in force on the borders of the Adirondacks, but are less abundant in the interior. Their content in graphite is variable. As an extreme it may reach 8 or 10 per cent, which is found only in the deposits owned by the American Graphite Co., near Hague. The average for the other deposits that have been worked probably does not exceed 3 per cent.

The companies who have reported a production for 1906 are: American Graphite Co., with mines at Graphite, near Hague, Warren co.; Crown Point Graphite Co., operating near Penfield pond, Essex co.; Pettinos Bros., with mines at Rock pond, Essex co.; Adirondack Mining & Milling Co., and Champlain Graphite Co.,

with mines at South Bay, near Whitehall, Washington co. The plant of the Ticonderoga Graphite Co., at Rock pond, was leased to Pettinos Bros., of Bethlehem, Pa., who operated it for only a brief period. The graphite rock was found to be cut out by a fault. The Adirondack Mining & Milling Co. was active only for a period of three weeks, and will not resume operations during the present year.

The Glens Falls Graphite Co. has been incorporated for the purpose of working a graphite deposit situated near Conklingville, 8 miles west of Hadley, Saratoga co. The deposit is described as a quartzose schist with a thickness of 50 feet where opened. The erection of a mill is in progress, which it is expected will be completed early in the year.

The Empire Graphite Co. is engaged in developing a property near Greenfield, Saratoga co.

Some prospecting has been done in the vicinity of Graphite with a view to locating a possible extension of the bed worked by the American Graphite Co. Drill tests have indicated that the quartzite underlies a considerable area to the west of that company's property. In three holes which were put down the graphitic bed was found to be from 19 to 22 feet thick and was encountered at 50 to 75 feet depth.

GYPSUM

The industries connected with the production of gypsum and its manufacture into commercial products have progressed rapidly during recent years. The advance has been due to the utilization of the material for wall plaster and plaster of paris, a branch of the industry that has been developed in New York State practically since 1900. Previous to that year the output of crude gypsum averaged less than 50,000 tons annually and was used almost wholly for agricultural purposes. Though the deposits of the State do not yield, as a rule, a material of high degree of purity, it has been found to be well adapted for making the usual grades of calcined plasters.

The quarries of gypsum are situated along a belt extending west from Madison county through Onondaga, Cayuga, Seneca, Ontario, Monroe, Genesee and Erie counties. The gypsum is found in one or more beds associated with the Camillus shale of the Salina group. The beds range up to 30 feet or more in thickness. They are worked only along the outcrop, generally by open pit methods, though underground mining is practised to some extent in the western

section. The manufacture of wall plaster is carried on principally in the vicinity of Syracuse, Onondaga co., at Wheatland and Garbutt, Monroe co., and at Oakfield, Genesee co.

The output of gypsum in crude form during 1906 amounted to 262,486 short tons, reported by 16 producers. In 1905 the output was 191,860 short tons and in 1904 it amounted to 151,455 tons. The greater part of the output was converted into wall plaster and plaster of paris, the combined product of these materials amounting to 163,451 short tons valued at \$595,285 against 130,268 tons valued at \$478,084 in the preceding year. The totals include only the quantities made from gypsum mined or quarried in the State; in addition there is a production of wall plaster and plaster of paris from imported material for which no returns are received. The quantity of gypsum that was ground and sold for land plaster amounted in 1906 to 20,656 short tons valued at \$46,094, against 19,815 tons valued at \$39,014 in the preceding year. A further portion amounting to 34,626 tons valued at \$58,076 in 1906 and to 27,980 tons valued at \$34,095 in the preceding year was sold in the crude state.

Production of gypsum

	1905		1906	
	Short tons	Value	Short tons	Value
Total output.....	191 860	.....	262 486	.....
Sold crude.....	27 080	\$34 095	34 626	\$58 076
Ground for land plaster.....	19 815	39 014	20 656	46 094
Wall plaster etc. made.....	130 268	478 084	163 451	595 285
Total value.....	.....	\$551 193	.....	\$699 455

Unusual attention has been given during the past year to the exploration of the gypsum deposits of the State, with results that promise to contribute toward the further expansion of the industry in the immediate future. In Onondaga county a new company has been engaged in the development of a deposit near Jamesville. A vertical shaft was put down to a depth of 100 feet and encountered about 40 feet of gypsum at the bottom. The Lehigh Portland Cement Co. and E. B. Alvord & Co. were active in exploring for deposits in the same district. The American Gypsum Co. has developed a property near Alabama, Genesee co., where the Akron Gypsum Co. has also opened a deposit. The former company in-

tends to erect a calcining plant. The Monarch Plaster Co. began production for the first time in 1906 from its mine situated at Wheatland, Monroe co. Exploratory operations have been under way also near Leroy and Oakfield, Genesee co.

IRON ORE

The revival of interest in iron ore mining noted in the preceding issue of this report has continued to exert a very favorable influence upon the industry of the State. A larger number of mines have been active during the past year than at any time since the memorable depression immediately following 1890 which brought about the abandonment of most of the local enterprises. The production, also, has shown a satisfactory gain, and with the increment that will be contributed by the new undertakings when they are under full headway, it should undergo still further expansion.

Altogether there were 11 companies engaged in mining operations. This number includes only those reporting a commercial production of ore. There were several other companies that had properties under exploration or development, and some of them will begin shipment during the current year.

The accompanying table gives the annual production of iron ore for the period of 1890-1906 inclusive. The statistics covering the years previous to 1904 are taken from the volumes of the *Mineral Resources* published by the United States Geological Survey, while those for 1904 and subsequent years have been collected at this office.

Production of iron ore in New York State

YEAR	MAGNETITE	HEMATITE	LIMONITE	CARBONATE	TOTAL ¹	Total value	Value per ton
	Long tons	Long tons	Long tons	Long tons	Long tons		
1890	945 071	196 035	30 968	81 319	1 253 393	.....	.....
1891	782 729	153 723	53 152	27 612	1 017 216	.....	.....
1892	648 564	124 800	53 694	64 041	891 099	\$2 379 267	\$2 67
1893	440 693	15 890	35 592	41 947	534 122	1 222 934	2 29
1894	.....	.....	.....	.....	242 759	.....	.....
1895	260 139	6 769	26 462	13 886	307 256	598 313	1 95
1896	346 015	10 789	12 288	16 385	385 477	780 932	2 03
1897	296 722	7 664	20 059	11 280	335 725	642 838	1 91
1898	155 551	6 400	14 000	4 000	179 951	350 999	1 95
1899	344 159	45 503	31 975	22 153	443 790	1 241 985	2 80
1900	345 714	44 467	44 891	6 413	441 485	1 103 817	2 50
1901	329 467	66 389	23 362	1 000	420 218	1 006 231	2 39
1902	451 570	91 075	12 676	Nil	555 321	1 362 987	2 45
1903	451 481	83 820	5 159	Nil	540 460	1 209 899	2 24
1904	559 575	54 128	5 000	Nil	619 103	1 328 894	2 15
1905	739 736	79 313	8 000	Nil	827 049	2 576 123	3 11
1906	717 365	187 002	1 000	Nil	905 367	3 393 609	3 75

The total shipments reported by the mines in 1906 amounted to 905,367 long tons valued at \$3,393,609. Compared with the previous year this was an increase of 78,318 tons or about 9 per cent. The production was more than double that reported for 1901 and was the largest for any year since 1891.

Classified as to variety the shipments consisted of 717,365 tons of magnetite, 187,002 tons of hematite and 1000 tons of limonite. Of the magnetite 479,644 tons were marketed in the form of concentrates with an approximate content of 65 per cent iron. The 237,721 tons of lump magnetite included in the total are estimated to average 60 per cent. The hematite and limonite range from 40 to 60 per cent, with an average probably of 45 per cent.

The magnetite concentrates were made from 729,091 tons of crude ore. Using that figure for a basis of calculation, the total quantity of ore hoisted from New York mines in 1906 was 1,154,814 long tons. In 1905 the quantity was 1,109,385 long tons.

The magnetite was derived mainly from the Adirondack region. The producers included Witherbee, Sherman & Co. and the Port Henry Iron Ore Co. at Mineville; the Arnold Mining Co. at Arnold; and the Chateaugay Ore & Iron Co. at Lyon Mountain. The Salisbury Steel & Iron Co. made a small output in connection with the development of their mine at Salisbury. In southeastern New York the Hudson Iron Co., which took over the Forest of Dean mine in 1905, began shipments. It has been the only producer in that section.

Of the total quantity of hematite reported the mines in the Clinton formation contributed a little more than half. The Franklin Iron Manufacturing Co. and C. A. Borst at Clinton and the Furnaceville Iron Co. at Ontario operated the mines. The remainder of the hematite came from St Lawrence and Jefferson counties where the Rossie Iron Ore Co. and the Old Sterling Iron Co. were active.

The single producer of limonite was the Amenia Co. at Amenia, Dutchess co.

The Fair Haven Iron Ore Co. was engaged in developing its properties near Sterling Station, Cayuga co., but produced only small quantities for trial purposes. It will begin commercial shipments this year.

In the Adirondack region, the exploration of the titaniferous magnetites near Lake Sanford, Essex co., has attracted much attention. It has been known for many years that the ore bodies are of enormous extent, and the recent tests have confirmed and added to the previous estimates. The successful issue of the enterprise must depend of course upon the metallurgical factor, which has hitherto

deterred iron manufacturers from attempting to utilize the ore in blast furnaces. It is the purpose of the present company to carry out a thorough investigation with a view to finding a commercial outlet for the ore. Considerable quantities of the ore have been mined and shipped for experiment to furnaces and to the magnetite concentrators at Mineville.

The Cheever mine near Port Henry, Essex co., is to be reopened. The mine which has been closed down for about 15 years has been equipped with pumps for unwatering the underground workings. It is planned to erect a concentrator during the present season.

The Benson mines in St Lawrence county have been taken over by new parties who will begin mining operations during the current year. It is intended at the start to use the old mill, after the necessary improvements have been made, but a new one will be erected if warranted by the developments.

The Hammondville district in Essex county has been under exploration by the Oliver Iron Mining Co. A magnetic survey was carried out, and the ground further tested by the diamond drill. The results have shown the existence of ore bodies hitherto unworked, but the reserves thus far found have not been sufficient to warrant a renewal of mining operations.

Notes on recent mining developments

Mineville. The production from this district was curtailed to some extent by a temporary suspension of operations on the part of the Port Henry Iron Ore Co. A slide of rock and earth last spring partly filled the large open pit in mine "21" and prevented access underground through the inclined shaft at the bottom. The shaft was retimbered and restored, but no ore was taken out for several months. Work in the pit has been discontinued. The company has started a new shaft in order to forestall any further trouble from similar sources. It is located 500 feet south of the present one and east of the Bonanza shaft of Witherbee, Sherman & Co. which is on the same ore body.

Mining was continued by Witherbee, Sherman & Co. in the five shafts worked during the preceding year, comprising the Joker and Bonanza on the Old Bed, A and B shafts on the Harmony ore body and Cook shaft. The two mills for treating the ore have likewise been in commission. Exploration work has been prosecuted by the company with little interruption, and the available ore supplies are well ahead of the production. The results obtained by diamond

drilling on the Old Bed have been particularly favorable. The extension of the deposit to the south has been practically established for a distance of several hundred feet beyond the present limits of the workings. With the enormous development shown by the ore body in cross-section, every foot added to its longitudinal extent means an important addition to the ore reserves.

The construction of a new power plant was begun by Witherbee, Sherman & Co. during 1906. The building is situated on the lake side at Port Henry, and is constructed of concrete made of cement and mill tailings. It will supply 800 kw. A 6 mile transmission line will connect the plant with the mines. This increment to the power supply will enable the company to enlarge considerably its mining operations.

Lyon Mountain. The mines were continuously active during 1906 and their output has been larger than for several years past. The increase has been made possible by the erection of a new mill which has doubled the former capacity for concentrating the ore and which was placed in operation for the first time during the summer. Other additions to the plant have been in course of construction, including the installation of a central power station, air compressors, new trackage, and houses for the miners.

The new mill was designed for the treatment of 1200 tons crude ore a day or 50 tons an hour. The results thus far obtained show that under normal conditions it is capable of a considerable larger output. It also effects an important saving in the item of labor. The concentrates turned out run about 63 per cent iron. In the old mill about 6 per cent of iron was lost in the tailings, while now the latter carry only 4 per cent as an average.¹

The central power station when completed will have a capacity of 3000 h.p. It is to replace the small power plants that are distributed among the different shafts and the old separator. The first third of the station developing 1000 h.p. has been completed and put in operation. It supplies power to the new mill through a 500 kw. generator directly connected to a Curtis turbine. In the same room is installed a cross-compound two stage air compressor for furnishing air to the drills.

As described in the issue of the bulletin for 1905, the mines at Lyon Mountain are very extensive. The ore bodies form a practically continuous belt from 5 to 6 miles long. Mining at present is

¹ Consult article by D. H. Newland and N. V. Hansell, in Eng. & Min. Jour., Nov. 10, 1906.

confined to the central part of the belt for a distance of about 2000 feet along the outcrop. There are three parallel veins in this part. The principal underground workings are the Hall slope and the adjacent nos. 3, 4 and 5 slopes situated on the front vein. The greatest depth reached is about 1400 feet on the incline, or 800 feet vertically. In the bottom of the Hall slope the horizontal drifts are about 200 feet wide. On the back vein the Burden and Cannon open pits, southeast of the slopes named, have continued to furnish a large quantity of ore.

The furnace of the Northern Iron Co., located at Standish near Lyon Mountain, is run on concentrates from these mines, the product being low phosphorus pig iron that finds a special market. Shipments of concentrates are also made to Pennsylvania furnaces.

Arnold hill. The Arnold Mining Co. closed down its mines and mill during the summer. Though the ore resources can not be regarded as exhausted, it was found difficult to maintain the production at a rate that would supply the mill for continuous running. The ore body that has been mined is irregular and showed evidences of pinching out in depth. There are several other deposits on Arnold hill, as well as on the adjacent hill to the east, from which an adequate output for the mill might be derived if properly developed.

Cheever mine. It is expected to begin ore shipments once more from this mine during the present year. The property has been inactive since 1893. According to the plans drawn up by Mr O. S. Presbrey, the owner, the Weldon shaft on the south end of the ore outcrop will be first reopened. There is known to be a quantity of ore still unworked in this section. A mill will be erected near the shaft for concentrating the leaner magnetite that has been stocked on the surface from previous operations and of which much remains in the mine. The ore previously shipped consisted entirely of lump material running 60 per cent or over in iron.

The Cheever mine is situated about 2 miles north of Port Henry close to the shore of Lake Champlain. It is based on a series of deposits that can be traced along the strike for nearly a mile. For a few hundred feet from the outcrop the ore dips sharply to the west or southwest, but then continues nearly horizontal, slightly rising in places, toward the ridge of gabbro which cuts it off on the west. It is frequently faulted and intersected by dikes. The old workings are said to cover an area of 40 acres. The deposits range up to 20 feet thick.

The ore in appearance and composition is much like that from the Mineville deposits. It is, however, lower in phosphorus than the Old Bed product, with an iron content of from 63 to 65 per cent. The shipments are reported by Smock to have amounted in all to 800,000 tons.

Lake Sanford. The property formerly owned by the McIntyre Iron Co., comprising over 100 square miles in western Essex county within which the Lake Sanford titaniferous magnetite deposits are located, has been taken over by parties for the purpose of exploration and development. The new company has been organized by Mr W. T. Foote, who is actively identified with its management. It is to be known as the Tahawus Iron Ore Co. Exploratory work has been under way throughout the past year.

The Lake Sanford ore bodies are the largest of their kind in the Adirondacks and undoubtedly rank among the largest deposits of iron ore in the entire country. They were first made known to the public through the descriptions of Professor Emmons in his reports on the Survey of the Second Geological District. They have since been investigated by Prof. J. F. Kemp,¹ who has given a very full account of their geology as well as of their mineralogical and chemical characters.

The diamond drill tests made during the past year have demonstrated that the ore bodies, which have hitherto been known only from outcrop, extend to considerable depths and that there are enormous resources of ore available for easy extraction. On the Sanford deposit the drills have shown as much as 360 feet of ore, and they have nowhere passed into the foot wall. This ore body was prospected by Professor Emmons who, as a result of his observations which have been recorded with much detail, estimated that it contained over 6,000,000 tons of ore within a distance of 2 feet below the adjoining surface. The bounds of the deposit as known to him have been greatly extended by subsequent investigations.

The ore from this locality is a coarse titaniferous magnetite. It is nearly free from admixed minerals of the wall rock, except on the borders where more or less feldspar and pyroxene are present. The deposit is well situated for working, as it outcrops along the sides and crest of a hill which rises about 300 feet above the shore of Lake Sanford. Quarry methods can be used here to advantage.

The recent exploration has disclosed the existence of an area of ore-bearing ground north and west of Calamity brook, near the

¹ Titaniferous Iron Ores of the Adirondacks. U. S. Geol. Sur. 19th An. Rep't, pt III.

outlet of Lake Henderson. The tract lies without the limits of the deposits that have been previously described. Though much of the ore is mixed with rock there are large bodies of practically solid magnetite of a quality not inferior to the Sanford ore. The following is a record of one of the drill holes.

	Feet	Inches
Lean ore, consisting of disseminated magnetite with feldspar and pyroxene	19	3
Rich ore	30	6
Rock and lean ore mixed	15	..
Rich ore	33	6
Rock carrying some ore.....	11	1
Lean ore	12	..
Rock and lean ore	8	..
Rich ore alternating with rock.....	10	7
Rock	5	..
	144	11

The Cheney ore bed west of Lake Sanford and the several deposits between Lakes Sanford and Henderson are known to be extensive.

An interesting feature that has been brought out by recent experimentation with the ores is the possibility of reducing the titanium by mill treatment. It has been established that in some cases at least this element is not uniformly distributed in chemical combination with the iron, as has been advanced by some writers. By crushing the ore to fine size and passing over magnets, a process like that used in the concentration of nontitaniferous magnetites, it is found that a separation can be made into a strongly magnetic portion and a residuum that is very weakly magnetic. The magnetic material shows on analysis a smaller content of titanium than the average of the ore used in the experiment, the content decreasing with the fineness to which the ore has been crushed. The weakly magnetic portion, which passes into the tailings, contains on the other hand an increased proportion of this element. The experiments seem to prove beyond all doubt that in such cases the ore consists of a mechanical mixture of two minerals, one of which is magnetite, with only a small amount of titanium, and the other a titanium-bearing iron oxid that is probably ilmenite. With the Sanford ore, it has been found that the titanium can be brought down to a limit where the utilization of the concentrates in the blast

furnace appears to be practicable. It may be pointed out that practically all of the so called nontitaniferous magnetites of the Adirondacks, as probably elsewhere, carry titanium, though the amount, of course, is small, usually less than 1 per cent.

Besides the possibility of concentration, it is not unlikely that a portion of the titaniferous ore can be used in crude state. Analyses show that the titanium is extremely variable. Some ores from the district contain only about 5 or 6 per cent, so that by mixing with ores free from titanium the percentage could be reduced to a fraction of that amount. The open-hearth process of steel making furnishes another possible outlet.

The Lake Sanford deposits are situated in the interior of the Adirondacks, on the slopes of the rugged mountain group centering around Mt Marcy. Their elevation of outcrop averages about 2000 feet above sea level. The nearest railroad point is North Creek, about 30 miles distant. The problem of transportation is thus a critical one; the construction of a branch railroad is now under consideration.

Forest of Dean. The Hudson Iron Co. began active mining at this locality during 1906. The company took over the mine in October 1905, but as the work of unwatering and reequipping extended over several months, no shipments were made until the following summer.

The Forest of Dean mine is situated 5 miles west of Fort Montgomery, Orange co. It has the longest record as a producer, probably, of any mine in the country that is now under operation. According to Beck it was worked as early as 1756. In the period from 1865 to 1894, when it was under the ownership of the Forest of Dean Iron Ore Co., the production amounted to over 500,000 tons.

The ore body consists of an immense shoot that is apparently folded upon itself into a synclinal, the two wings of which extend to the surface. The wall rock and ore dip steeply southeast, while the latter pitches to the northeast. The horse of gneiss separating the two wings of the fold wedges out with depth. Access to the underground workings is had through a slope driven on the foot wall. The slope has been carried to a distance of 1700 feet from the surface and a vertical depth of 700 feet.

The ore is a rich magnetite of non-Bessemer character. An analysis quoted from Smock's report shows the following percentages:

Iron oxid (Fe_2O_3).....	83.56
Silica (SiO_2)	5.00
Phosphoric anhydrid (P_2O_5).....	2.30

Alumina (Al_2O_3)	tr
Manganous oxid (MnO)	.63
Lime (CaO)	5.51
Magnesia (MgO)	1.19
Carbon dioxid (CO_2)	1.05
Water (H_2O)	.20
	99.44

The company owns a furnace at Secaucus, N. J., to which the ore is shipped. In order to reach the Hudson river, a tramroad 4 miles long has been built. At the terminal of the road the ore is loaded into the buckets of an aerial rope conveyor, 6300 feet long, which carries it to the dock at Fort Montgomery where there is a 1000-ton storage bin. The power for driving the air compressor and pump at the mine is taken from the adjacent Popolopen creek.

Caledonia mine. This mine situated in the hematite district of St Lawrence and Jefferson counties has been operated in recent years by the Rossie Iron Ore Co. It has furnished altogether probably 500,000 tons of ore. The record for the past year has been a very creditable one, the output having been more than double that for 1905, while large resources have been opened for future exploitation. The company has recently enlarged and improved its surface plant which will enable it to increase the production still further.

The ore is a fairly rich soft hematite, running from 50 to over 60 per cent in iron. Its quality seems to improve somewhat with the progress of mining in depth.

It carries a relatively high proportion of lime which with its excellent physical character makes it very adaptable to furnace treatment. A rough sorting is required to remove admixed rock, and about one fourth of the material hoisted is thus rejected at the surface. An analysis¹ of shipping ore shows the following chemical constituents:

Iron (Fe)	52.71
Silica (SiO_2)	10.12
Alumina (Al_2O_3)	7.04
Manganous oxid (MnO)	1.69
Lime (CaO)	7.04
Magnesia (MgO)	0.38
Carbon dioxid (CO_2)	5.41
Sulfur (S)	.03

¹ See article by Robert B. Brinsmade, Eng. & Min. Jour. Sept. 15, 1906.

From an average of several determinations, the phosphorus may be placed at about .5 per cent.

The ore occurrence furnishes an interesting example of the replacement type of deposits. The associated rocks are crystalline limestone and schists of Precambrian (Grenville) age and Potsdam sandstone. The Precambrians have a northeasterly strike and a variable dip generally to the southeast. They are overlain by the sandstone with a marked erosional unconformity at the base. The dip and strike of the sandstone are subject to rapid changes from place to place, though it usually lies more nearly horizontal than the other formations.

The limestone and schist form an interbedded series that is seemingly conformable. Alternating belts of the two rocks occur across the strike, the repetition being due probably to successive folds with northeast-southwest axes. The schist is a quartzose graphitic variety, finely laminated as a rule. It doubtless represents an original silicious shale that contained considerable carbonaceous matter. Secondary alteration, apparently connected with the process of ore formation, has resulted in the development of chlorite from the silicates, forming a chlorite schist. This is locally called serpentine, but there is very little true serpentine present, so far as observed. The chlorite schist is always closely associated with the ore.

In many places the sandstone capping is notably altered at the base. It is decomposed to a soft iron-stained material, at times carrying a fairly large percentage of hematite and grading into the ore bodies below.

At the Caledonia mine the deposits follow the contact between a belt of limestone which constitutes the foot wall and an overlying belt of schist. They have a pronounced irregular often sinuous form, with bulges and pinches along the strike and dip. They frequently branch and run off for some distance into the hanging and foot walls. The limestone along the contact has been dissolved out to form deep cavities and these may be filled with ore. Horseshoes of both limestone and schist are not infrequently encountered in the midst of the deposits. The workings do not appear to have penetrated anywhere the Potsdam, though it occurs on the hanging side within probably 100 feet of the edge of the limestone. Where seen on the surface above the workings it has a high dip to the east. The tilting has been due probably to settling of the surface owing to removal of the limestone by solution.

There are abundant evidences that the ore deposits have originated by a process of replacement. The cores of schist show gradation from the central unaltered nuclei outward into the rich hematite. Specimens of the ore may be found that still show the banding and cleavage characteristic of the schist. The presence of graphite, which would naturally be the most resistant of the minerals to solvent action, furnishes a clue to the origin of the ore even when all the other primary constituents have been removed. The relatively high percentages of silica and lime in the ore are likewise suggestive in that connection.

As to the source from which the ore has been derived, Prof. C. H. Smyth¹ jr has given an explanation that accords best with the geological phenomena surrounding the occurrence. Though based principally on observations made at the Old Sterling mine, the theory is equally applicable to the Caledonia ore body and in fact to all of the deposits in the district. Briefly stated, it ascribes the formation of the ore to the circulation of underground waters which have dissolved the iron-bearing minerals from the adjacent rocks and deposited their burden in the form of oxid and carbonate when they came in contact with the limestone. The source of the iron is to be traced to the presence of pyrite and magnetite in the schist. There are bands of schist impregnated with pyrite in the vicinity of the Caledonia mine, as well as at the Dickson and Old Sterling mines. These pyritic bands are developed on a large scale throughout the Grenville schists of St Lawrence county and have for a number of years been the object of mining. By oxidation, the iron would be brought into solution as ferrous and ferric sulfates. Free sulfuric acid would also result and would react upon the veins and disseminations of magnetite in the schist. On coming in contact with the limestone, the solutions would be decomposed, the iron being precipitated as carbonate or limonite, while at the same time the lime carbonate would pass into solution. By subsequent alteration the carbonate and limonite have been changed to hematite. Residual masses of unaltered carbonate are occasionally found in the Caledonia mine. The iron has been precipitated in part in the body of the schist, without the agency of limestone.

Dickson mine. The Old Sterling Iron Co. has recently reopened this property, which has been inoperative for several years. The mine is situated on the southwestern end of the belt in which

¹ N. Y. State Mus. 47th An. Rep't, 1894. p. 692.

the Caledonia and Old Sterling deposits are located, about a mile from the latter. It was first worked in 1858.

The ore is an earthy hematite, occurring within graphitic schist. There is no limestone exposed in the workings and this rock does not appear to be present in the immediate vicinity. The deposits occupy zones of replacement following the bedding planes of the schist. The dip is to the northwest in an opposite direction to that at the Caledonia mine. The workings have reached a depth of 160 feet on the dip, and range from 10 to 40 feet wide.

Ore has been mined in the past from several pits between the Old Sterling and Dickson mines. There are good opportunities for exploration in the vicinity, as well as in the interval between the Old Sterling and the Caledonia mines. All of the deposits practically that are known have been located by surface outcrops. Their aggregate extent is small compared with the body of the schist, and it is not at all improbable that ore bodies may be found beneath the drift-covered areas. Tests with the dip needle show that the ore bodies have no appreciable magnetic properties, so that exploration would have to be carried on by costeaning or drilling. The thickness of the drift, judging from sections exposed in the district, is nowhere very great, probably less than 50 feet in most places.

The Clinton hematite

BY C. A. HARTNAGEL

The Clinton ores occur as beds in the Clinton formation and extend for a distance of about 120 miles, from Herkimer county as far west as Monroe county. In the eastern section there are present two and some times three beds of ore. The lower oolitic bed is about 8 inches thick and is not at present worked, though in character it is very similar to the oolitic bed occurring 2 feet higher; which is the only one of the three beds now exploited. The lower politic bed is quite local in distribution and is definitely known only on the property of the Franklin Iron Manufacturing Co. The upper bed, locally known as "red flux," is found 24 feet higher. This bed is 5 feet thick and is strictly a fossil ore, consisting largely of bryozoan fragments and lacking oolites which are so characteristic of the lower beds. The analysis of the upper bed gives about 30% iron, which is too low to be profitably employed at present.

In the western section only one bed of ore is found. It here combines the character of the "red flux" and oolitic beds of the east-

ern section, in that it is made up partly of fossil fragments and partly of oolites. Its stratigraphic position in relation to the beds of the eastern section is not definitely known though it appears to be most closely related to the lower or oolitic beds.

The dip of the Clinton formation varies from 50 to 100 feet per mile and throughout its extent from Herkimer county to Monroe county contains one or more beds of ore. If only a single bed with an average thickness of 20 inches is used as a basis for calculation, the quantity of ore available in each mile of outcrop and an equal distance on the dip amounts in round figures to 5,000,000 long tons.

Furnaceville Iron Co. This company is engaged in mining ore near Ontario Center, Wayne co. The open cut method for mining the ore is here used to good advantage. The overlying soil and rock, 18 to 20 feet thick, are first loosened by blasting and then removed with steam shovels and revolving derricks. To loosen the soil and rock, holes extending downward through the capping and 3 inches into the ore are made with churn drills. The holes are 16 feet apart, the first row being drilled 6 feet from the edge of the trench. The loosened material is removed by steam shovels which drop the material into the buckets of the derricks which convey it to the spoil banks, opposite the long face of the trench and just beyond the edge of the ore which is being cleared of its overburden. Two sets of steam shovels and derricks, working in parallel and along the strike of the bed clear the ore for a width of 60 feet. A layer of limestone, 15 to 18 inches thick, remains on the ore which is not readily removed by the steam shovels. This is blasted away or removed by hand. The ore which is 22 inches thick is loosened by blasting. Steam drills are used and the holes are about 3 feet apart and 3 feet back from the edge of the ore. The drill holes extend about 3 inches into the underlying argillaceous limestone. A small amount of the latter comes off with the ore but it is readily removed. The ore is broken with hammers into convenient size for handling. The ore is then loaded into buckets holding about $2\frac{1}{2}$ tons. A derrick carries the buckets directly to the cars which stand on a branch track of the Rome, Watertown & Ogdensburg Railroad. The track is located on the edge of the trench on the side opposite the spoil bank, and is moved back whenever a new working face is established along the strike. About 16 buckets of ore are needed for a car of 80,000 pounds. The ore is shipped to Emporium, Pa.

Wolcott. The Clinton ore was formerly mined near Wolcott.

24 miles east of Ontario. A furnace was in operation there as early as 1824. It is no longer in operation, the last blast having been made in 1869. The ore for the furnace was obtained in township 41, near Black creek, about 4 miles east from the furnace. The overburden is said to consist of 20 feet of soil and rock, the ore being 30 inches thick. The section is no longer accessible for measurement. A small amount of ore was also obtained just below the furnace along Wolcott creek. At present the ore shows a thickness of 14 inches, but as it lies immediately beneath surface soil, it undoubtedly represents but a part of the thickness of the original ore bed.

Fair Haven Iron Co. Ten miles northeast from Wolcott, the Fair Haven Iron Co. has recently begun to take out ore by the open cut method. The holdings of the company consist of 280 acres located at Sterling Station, Cayuga co. The opening for the ore is 400 yards southwest of the station and adjacent to the railroad tracks. The operations are conducted on the opposite side of the railroad from the old workings of the Furnaceville Iron Co. A siding from the railroad leads directly to the workings. The equipment of the company consists of one 60-ton Marion steam shovel, one 15-ton locomotive crane, two derricks, one 30-h.p. boiler, etc.

The company is at present engaged in excavating a trench along the strike of the ore. No large amount of ore has been taken out, but the company will begin shipping during the current year.

Clinton. All the operations now carried on at Clinton for the production of ore are by drifting. The open-cut method was abandoned principally because of the increasing thickness of the overburden.

The mining operations at Clinton are at present carried on by the Franklin Iron Manufacturing Co. and Mr C. A. Borst. The former company operates what were formerly known as the Franklin and Clinton mines. The operations of Mr Borst are carried on a short distance farther north at the two beds known as the Elliott and the Butler.

At both of the mines at Clinton the long wall method of working is used. Briefly this plan consists of a main gangway with branches so arranged that a space of 50 feet can be worked on each side of them. In mining, the working face is kept a short distance ahead of the gangway. When a working face is established the ore is obtained by drilling diagonally from the top of the bed. Upon blasting, the front and lower portion of the ore is thrown out. The ore is

trimmed in the mine and loaded into the mine cars. The remaining ore and enough of the overlying shale is then removed by drilling horizontally and blasting, so as to give sufficient hight for the miners to work.

The ore varies from 30 to 36 inches in these mines so that about 18 to 24 inches of shale is removed. The waste from the ore and all the shale removed goes into the gob. The roof is further secured by timbering. The posts are placed parallel to the working face and from 5 to 10 feet apart depending upon the nature of the roof.

The ore is hauled from the mine workings on cars. In the Franklin Iron Manufacturing Co.'s mines the cars are drawn by mules. In the Borst mine, steel cars with roller bearings are used; the grade in the mine is so slight that they can be operated by hand. In this mine steel rails connected by fish plates are used. The track rests directly on the rock so that in reality it serves as a portable railway. In the Franklin mines ventilation is made more perfect by means of a central air shaft.

The product of the Borst mines goes principally to paint manufacturers. The ore from the Franklin mines is smelted at the company's furnace at Franklin Springs about 2 miles south from the mines.

MILLSTONES

Millstones are obtained in Ulster county. The industry is a small one, but it has been established for more than a century and still furnishes most of the millstones made in this country. The product is known as Esopus stone, Esopus being the early name for Kingston, once the principal point of shipment.

The millstones are quarried from the Shawangunk grit, a light gray quartz conglomerate found along the Shawangunk mountain from near High Falls southwest toward the Pennsylvania border. The Cacalico stone obtained in Lancaster county, Pa., and the Brush mountain stone, found in Montgomery county, Va., are of similar character. In Ulster county the grit rests upon the eroded surface of gray Hudson River shales and is overlain by red shale. It has generally been correlated with the Oneida conglomerate of central New York, though recent investigations have shown that it belongs higher up in the series, namely in the Salina. Its thickness ranges from 50 to 200 feet.

The grit is composed of quartz pebbles of milky color inclosed in a silicious matrix. The pebbles are more or less rounded and vary from a fraction of an inch up to 2 inches in diameter. The texture is an important factor in determining the value and particular use of the finished millstones.

The size of the stones marketed ranges from 15 to 90 inches. The greater demand is for the smaller and medium sizes, with diameters of 24, 30, 36, 42 and 48 inches. A pair of 30-inch millstones commonly sells for \$15, while \$50 may be paid for a single stone 60 inches in diameter. The largest sizes bring from \$50 to \$100. Besides the common type of millstones, disks are furnished which are employed in a roll type of crusher known as a chaser. The pavement of such crushers is also supplied by the quarrymen, in the form of blocks. Quartz, feldspar and barytes are commonly ground in chasers.

Most of the Ulster county quarries are situated along the northern edge of the Shawangunk mountain. Kyserike, St Josen, Granite and Kerhonkson are the principal centers of the industry while the distributing points include New Paltz and Kingston in addition to those named. The industry is carried on intermittently, many of the producers engaging in other occupations during a part of the year.

The market for millstones has been curtailed of late years by the introduction of rolls, ball mills and other improved forms of grinding machinery. The roller mill process has displaced the old type of cereal mills, particularly in grinding wheat. The small corn mills distributed throughout the southern states, however, still use millstones and furnish one of the important markets for the New York quarries. A part of the product is sold also to cement and talc manufacturers.

The production of millstones in 1906 amounted to a value of \$22,442, or nearly the same as in the previous year when a valuation of \$22,944 was reported. The production in 1904 was valued at \$21,476.

MINERAL PAINT

The term mineral paint is here used to designate the natural mineral colors obtained by grinding an ore or rock. The materials suitable for this purpose that are found in New York State include iron ore, shale, slate and ocher.

For metallic paint and mortar colors some form of iron ore, generally hematite or limonite, is commonly employed, but only a few localities are known where the ore possesses the requisite qualities of color and durability. The fossil hematite from the Clinton formation is perhaps most widely used in this country. The mines owned by C. A. Borst at Clinton, Oneida co., and those of the Furnaceville Iron Co. at Ontario, Wayne co., supply much of the crude material.

The red hematite mined by the Rossie Iron Ore Co. at Rossie, St Lawrence co., also yields a good metallic paint.

Mineral paint made from shale and slate is quite extensively used for wooden structures. When there is a considerable percentage of iron oxids present, the shale and slate may be sold for metallic paint. Their value depends largely upon the depth and durability of their color; but the degree of natural fineness and the amount of oil required in mixing must also be considered in determining their utility. At Randolph, Cattaraugus co., beds of green, brown and bluish shale occur in the Chemung formation. They are worked by the Elko Paint Co. In years past red shale has been obtained in Herkimer county from the Vernon beds at the base of the Salina. A similar material occurring in the Catskill series has been worked at Roxbury, Delaware co. The red slate of Washington county, which belongs in the Cambrian, is also ground for paint. The Algonquin Red Slate Co. of Worcester, Mass., and A. J. Hurd of Eagle Bridge produce this material.

A product known as mineral black is made by grinding slate found in the Hudson River series.

The ferruginous clay called ocher occurs quite commonly in the State, but no deposits are exploited at present. A bed occurring on Crane mountain, Washington co., once supplied a considerable quantity.

Sienna, a variety of ocher, occurs near Whitehall. The deposit is a thin stratum in glacial drift and has been worked on a small scale.

In addition to the producers above mentioned, the Clinton Metallic Paint Co. of Clinton, and the William Connors Paint Manufacturing Co. of Troy, are engaged in the manufacture of mineral paints from New York materials.

The production of mineral paints in 1906 was as follows: metallic paint and mortar color 2714 short tons valued at \$29,140; slate pigment 2045 short tons valued at \$15,960. In the year 1905 the following quantities were reported: metallic paint and mortar color, 6059 short tons, valued at \$70,090; slate pigment, 2929 short tons valued at \$22,668. These quantities include only the output made within the State from local materials. A part of the crude material is shipped each year to points outside of the State for manufacture. An output of 9382 tons valued at \$22,949 was reported by four firms who sell the crude ore or rock to paint grinders.

NATURAL GAS

There are 15 counties in the State in which natural gas was produced for lighting and heating purposes during the past year. The principal supplies were derived from the fields in Allegany, Cattaraugus, Chautauqua and Erie counties, the aggregate value of their output being about 85% of that for the whole State. It is gratifying to note that the production reported from the different fields, with some exceptions, has been gradually increasing of late years. This is due in part, no doubt, to the greater care with which the supply is now conserved and utilized, as compared with the wasteful methods once used; but it would also appear that the natural resources are not in danger of rapid exhaustion.

The gas pools are found at several horizons in the geological column, ranging from the Potsdam sandstone in the Cambric to the Chemung and Portage shales and sandstones of the Devonian. As a rule there is a definite horizon for each field, though some wells have yielded gas at different depths and from various rock formations. The Trenton limestone seems to be the lowest of the prolific strata from which gas has been obtained in large quantity. It affords the main supply in the wells of Oswego and Onondaga counties. The Medina sandstone has come into prominence lately by reason of the large pools that have been found in it in Erie county, now the most productive of the State. The wells recently put down at Silver Creek, Chautauqua co., are also bottomed in the Medina. The Portage and Chemung strata yield most of the gas produced at other localities along the shore of Lake Erie in Chautauqua co., and practically the entire output of Cattaraugus and Allegany counties.

One of the leading developments of the past year has been the opening of a promising field at Pavilion, in the southeastern part of Genesee county. Five wells were drilled by the Pavilion Natural Gas Co., and are reported to have given indications of a flow amounting to over 2,000,000 cubic feet a day. They are located on the Starr and Hooker farms. It is intended to drill additional wells during the present year. The company furnishes gas to the village of Pavilion and has laid a pipe line to Leroy for the purpose of supplying that place. A second company was formed and secured leases within the village where it drilled four wells, of which all but one were dry. The gas is found at a depth of from 1700 to 1850 feet in what is believed to be the Medina sandstone. A bed of rock salt 84 feet thick was penetrated in well no. 2 of the Pavilion Natural Gas Co.

At Seneca Falls, Seneca co., a well drilled by H. W. Knight encountered gas at 1450 feet. It was continued to a depth of 1617 feet, giving a flow estimated at 20,000 cubic feet a day.

Several wells have been drilled for oil and gas in the vicinity of Dansville, Livingston co., during the past few years without any success. Further exploration has been undertaken at a locality about 4 miles south of the village, and has resulted in the discovery of a gas horizon at 1200 feet. It is intended to continue drilling to 2500 feet.

The Cherry Creek Oil Co. located a very successful well near Cherry Creek, in eastern Chautauqua county. The flow at the outset was above 500,000 cubic feet and has averaged about 150,000 cubic feet a day. The gas is used in Cherry Creek.

The Frost Gas Co. of Fredonia, Chautauqua co., and the Welch Gas Co. of Westfield in the same county are new producers. The wells owned by the former company are situated at Sheridan. The Welch Gas Co. drilled one well to a depth of 2355 feet when a pool was encountered which gave a measured flow of 235,000 cubic feet a day, afterwards settling down to 100,000 cubic feet. The horizon is said to be the white Medina sandstone. The well is located in Westfield and has been connected with the village mains. The company has a second well under way which had reached a depth of 2000 feet at the close of the year.

The gas field at Silver Creek, Chautauqua co., which was first opened in 1904, continues to be very productive. It supplies Dunkirk, Forestville and Silver Creek. The South Shore Gas Co. and the Silver Creek Gas & Improvement Co. handle the output.

In Steuben county the North Side Gas & Oil Co. has been engaged in exploration at Ferenbaugh, 4 miles north of Corning. A flow of about 25,000 cubic feet was struck in the first well at a depth of 250 feet. The company will continue operations. At Keuka a test well was put down on the farm owned by E. Newman, resulting in the discovery of small pockets at depths from 60 to 210 feet. Owing to an inrush of water the well has not been commercially productive. The Tusco Oil, Mineral & Gas Co., operating at Woodhull, reported the discovery of gas, though no attempt was made to utilize the flow.

Yates county reported an output of gas for the first time in 1906. The Rushville Mining & Gas Co. drilled two wells during the preceding year which supply the village of Rushville.

The occurrence of natural gas near Voorheesville, Albany co., may be recorded, though there has been no commercial production. A

well drilled for water opened a pocket in the Hudson River shales at 150 feet depth. The flow rapidly diminished.

Production. The value of the output of natural gas in 1906, as reported by the individual producers and pipe line companies, was \$766,579. In 1905 the output was valued at \$607,000 and in 1904 at \$552,197. The gain for the year was thus about 26 per cent, while in the last years there has been an increase of nearly 50 per cent.

The quantity of gas produced in 1906 amounted to 3,007,086,000 cubic feet. In arriving at this total estimates are included for certain producers who were unable to supply exact figures, but, as it is only the smaller operators as a rule that do not keep records of their wells, the estimate is very close to the actual production. The quantity of gas yielded by the wells in 1905 is estimated at 2,639,130,000 cubic feet, and in 1904 at 2,399,987,000 cubic feet.

Production of natural gas

COUNTY	1904	1905	1906
Allegany-Cattaraugus.....	\$183 830	\$204 430	\$247 208
Chautauqua.....	31 822	26 232	94 345
Erie.....	254 899	281 253	317 554
<i>a</i> Livingston.....	32 451	41 805	52 805
Onondaga.....	15 350	16 825	16 385
Oswego.....	14 990	13 583	13 182
<i>b</i> Wyoming.....	18 855	22 872	25 100
Total.....	\$552 197	\$607 000	\$766 579

a Includes also Seneca, Schuyler, Steuben, Ontario and Yates counties.

b Includes also Niagara and Genesee counties.

The average value of the natural gas as given in the returns ranges from a minimum of 18 cents to a maximum of 50 cents a thousand cubic feet. The general average for the whole State during the last three years has been about 25 cents.

The largest relative increase in production during the past year was shown by Chautauqua county, with a total valued at \$94,345 against \$26,232 in 1905. Erie county reported an output valued at \$317,554 as compared with \$281,253 in the preceding year. There was also a notable increase in the fields of Allegany and Cattaraugus counties.

PEAT

The application of peat to industrial uses has continued to attract attention during 1906. As heretofore the main object in view has been to utilize the material for fuel purposes. The enterprises in New York State, however, have not been carried as yet beyond the experimental stage, and there were no plants making peat fuel on a commercial scale. A new feature of the subject that has come into prominence in the last year is the possibility of using peat for paper manufacture, a development suggested by recent work along this line that has been carried out in Europe.

The latest, as well as, perhaps, the most important experiments in the utilization of peat for fuel within the State has been started at Heuvelton, St Lawrence co. They are based on different principles than have heretofore been adopted for the purpose. The plant is installed on a boat, 125 feet long and 30 feet wide, which is self-propelling and carries all the machinery required for excavating the peat and converting it into marketable fuel. It is planned to operate on Black lake near Ogdensburg, where there are reported to be peat deposits at no great depths. The dredging apparatus consists of two conveyor chains that travel along inclined ways independently mounted and swinging so as to cover a width of 40 feet in front of the boat. The inclined ways can be raised or lowered as required, according to the depth from which it is necessary to dredge the peat. The latter is carried by the bucket chains into a hopper from which it is spouted to the first of the machines designed for its treatment, where it is mashed and kneaded. This machine breaks up the coarser material and at the same time expels a portion of the absorbed water. In the next process the peat undergoes a more thorough drying by heat. The drier resembles somewhat a horizontal water tube boiler and is made up of a large number of tubes arranged in tiers, the succeeding tubes of each tier sloping slightly in opposite directions. Steam is admitted around the tubes, while the peat is carried through them by special conveyors until it has made the entire circuit. After drying the peat is to be compressed into briquets or produced for use in gas producers. All the machinery is operated by electric power supplied by a boiler and engine that have been installed on the boat. The plant is built after the designs of Mr Walter T. Griffin who has also supervised its construction. It was not completed in time to be placed in operation before the close of the year.

The manufacture of peat into the heavier grades of paper, such as are employed in making cartons, boxes, etc., was commenced last

year by the Pilgrim Paper Co., who have erected a plant at Capac, Mich. It is reported that very satisfactory results have been obtained during the short period of activity. A subsidiary company has been incorporated for the purpose of establishing the industry in New York State and has acquired for that purpose a tract of peat land near Oswego. The special machinery requisite in using peat fiber is made after the Esser patents which are owned in Vienna, Austria. A small proportion of wood pulp in the form of screenings or of newspaper is incorporated with the fiber. The finished product has a strong, smooth texture and is quite resistant to dampness or moisture in contrast with paper made from ordinary materials. The peat found in the vicinity of Oswego is well adapted for this use, owing to its perfectly fibrous condition and freedom from foreign matter. A carload of peat was also shipped from Glens Falls to Michigan for experimental purposes.

PETROLEUM

The petroleum industry of New York State shows few changes from year to year. There have been no important additions to the areas of the oil fields for some time, yet the output has been fairly well maintained as is evidenced by comparison of the annual totals which are included herewith. The stability of the industry may be ascribed largely to the fact that the oil pools when once tapped continue productive for a relatively long period. The increment from the new borings that are put down each year about counterbalances the decline in output from the old wells. At present the average daily yield of each well is less than one barrel. Pumping is generally resorted to and for this purpose gas engines, which are supplied from the natural gas that accompanies the petroleum, are used. From the storage tanks of the individual producers the oil is run into pipe lines for transport to the refineries. There are six pipe line companies operating in the State who handle practically all of the product.

The oil-bearing territory includes portions of Cattaraugus, Allegany and Steuben counties. It is the northernmost portion of the Appalachian field, which reaches its main development in the states of Pennsylvania, Ohio and West Virginia. The oil in the New York fields is associated with dark colored sandstones belonging to the Chemung formation of the Upper Devonian.

During the year 1906 a promising discovery of oil was made in the Short Tract district of northern Allegany county, where several

wells have been drilled within the last five or six years, but without establishing the existence of oil in quantity. The well was put down on the Van Nostrand farm, 5 miles from Fillmore. At a depth of 568 feet oil began to flow under natural pressure but soon subsided. A yield of about 10 barrels a day has been secured by pumping. The product is an amber oil of light specific gravity. Further drilling has been undertaken to test the importance of the discovery.

In the Bolivar district of southwestern Allegany county, a possible enlargement of the known productive limits is indicated by recent drilling at a locality 8 miles south of the village of Bolivar. Several wells were opened last year for gas, and one of them tapped an oil-bearing stratum at 1000 feet depth, yielding about five barrels a day.

The output of petroleum in New York State amounted in 1906 to 1,043,088 barrels of 42 gallons, as compared with 949,511 barrels in the preceding year. The estimated value of the yield was \$1,721,095, or an average of \$1.65 per barrel. On the same basis the production in 1905 was valued at \$1,566,931. In the compilation of the statistics for these years, as well as for 1904, the receipts of oil reported by the pipe line companies have been used. The list of companies is as follows: The Allegany Pipe Line Co., Columbia Pipe Line Co., Union Pipe Line Co., and Fords Brook Pipe Line Co., of Wellsville, and the Tide Water Pipe Co., Limited, of Bradford, Pa.

^aProduction of petroleum in New York

YEAR	BARRELS	VALUE
1891.....	1 585 030	\$1 061 970
1892.....	1 273 343	708 297
1893.....	1 031 391	660 000
1894.....	942 431	790 464
1895.....	912 948	1 240 468
1896.....	1 205 220	1 420 653
1897.....	1 279 155	1 005 736
1898.....	1 205 250	1 098 284
1899.....	1 320 909	1 708 926
1900.....	1 300 925	1 759 501
1901.....	1 206 618	1 460 008
1902.....	1 119 730	1 530 852
1903.....	1 162 978	1 849 135
1904.....	1 036 179	1 709 770
1905.....	949 511	1 566 931
1906.....	1 043 088	1 721 095

^aThe statistics for the years 1891-1903 inclusive are taken from the annual volumes of the *Mineral Resources*.

PYRITE

There was a small output of pyrite from the St Lawrence county mines during the past year. The quantity reported was 11,798 long tons valued at \$35,550, as compared with 10,100 long tons valued at \$40,465 in 1905. The production was rather incidental to the preliminary work of development, than to regular mining.

The deposits in St Lawrence county have been under exploitation for several years, yet mining operations, hitherto, have had a desultory character without any stable or permanent basis. The main difficulty which seems to have prevented a successful issue of the various undertakings started in this field has been the lack of adequate capital to open the mines and equip them for large scale operations. The problem involved is very similar to that of magnetite mining in the Adirondacks.

The St Lawrence Pyrite Co., who took over the Stella mine at Hermon, has inaugurated the most extensive, as well as, perhaps, the most promising developments that have yet been undertaken. The company recently completed a 500 ton mill on the property and has been engaged during the year in opening the mines to supply an adequate output of ore. A railroad from the village of Hermon to Dekalb Junction has been built by the company and will enable it to ship the ore by car direct from the mill. There are five ore deposits on the property, of which two are being worked.

The Cole mine near Gouverneur, formerly owned by the Adirondack Pyrite Co., has been taken over by the American Pyrites Co. The mine has shipped in the past a considerable quantity of lump ore. It is equipped with a mill.

QUARTZ

Westchester county has contributed a small output of quartz each year. The mineral is obtained from veins where it occurs nearly pure and also from pegmatite dikes in which it is mixed with feldspar. The product is used in part for pottery, being shipped to manufacturers of these articles at Trenton, N. J.; it is also employed in making wood filler and silicate paint. The Bridgeport Wood Finishing Co. of New Milford, Ct., and P. H. Kinkel of Bedford, N. Y., were the only producers during the past year.

SALT

The salt production in the State has shown an increase of about 5 per cent for the past year. The total quantity of salt of all kinds mined or manufactured in 1906 as reported by the different companies, was 9,013,993 barrels of 280 pounds, on which a value of \$2,131,650 was placed. The corresponding returns for 1905 aggregated 8,575,649 barrels with a valuation of \$2,303,067 and those for 1904 amounted to 8,724,768 barrels with a value of \$2,102,748. The output in 1906 exceeded the total reported for any previous year; the next largest production being that given for 1904.

The marketable grades of salt that are produced in New York include rock salt and the different varieties of brine salt known as coarse solar, common fine, table, dairy, agricultural and packers salt. In addition to the salt that is sold as such, a very large quantity is converted into soda products. The Solvay Process Co., at Solvay near Syracuse, manufactures such products directly from brine that is supplied by their own wells, and the amount of salt thus used is included in the statistics above reported.

The solar salt is made entirely in Onondaga county. Syracuse has long been the center of this branch of the industry which was first started in the vicinity in 1789. A natural brine with from 17 to 20 per cent sodium chlorid is employed. The brine is stored in glacial gravels and has evidently been formed by circulation of ground waters through adjacent beds of rock salt. Most of the wells are located on the Onondaga Reservation which is under State control. The brine is supplied to the individual evaporating plants at a fixed charge.

The manufacturers of brine salt at other localities in the State obtain their supplies from wells driven into the rock salt. Fresh water is introduced into the wells from the surface and pumped up after becoming nearly saturated. By this method a brine carrying about 25 per cent sodium chlorid may be secured, or within 1 per cent or so of the saturation point for water. The Tompkins county salt is thus obtained from depths exceeding 2000 feet.

Altogether there were 32 companies engaged in the production of salt in the State during the past year, as compared with 31 companies in 1905 and 30 in 1904. Of the total number, Onondaga county was represented by 21. The International Salt Co. operated four plants as follows: Ithaca works, Ithaca; Cayuga works, Myers; Glen works, Watkins; and Yorkshire works, Warsaw. The Hawley and Warsaw works at Warsaw owned by the company were inactive.

The Rock Glen Salt Co. has taken over the plant at Rock Glen, Wyoming co., once worked by the Kerr Salt Co.

The Sterling Salt Co. has opened a mine of rock salt at Cuyler-ville, Livingston co. The shaft was started in 1905 and was finished and equipped for hoisting in the latter part of 1906. It is bottomed at about 1100 feet in a bed of salt that averages 21 feet thick. It has a cross-section of 11 by 21 feet over all and is divided into two hoisting compartments and one ladderway. The equipment on the surface and underground is of the most approved type. The buildings, including shaft house, power houses and storage bins, are constructed of reinforced concrete. The output of the mine when under full headway will exceed 1000 tons a day. The first shipment was made in November.

The Retsof Mining Co. was a producer of rock salt from its shaft at Retsof, Livingston co., which for several years past has been the only active mine in the State. There are three salt shafts that are not now operated.

The accompanying tables show the production of salt distributed among the various grades as marketed. The output listed under "Other grades" is made up principally of rock salt and salt used for soda manufacture, but includes small quantities of other kinds not specified in the returns. The valuation placed upon this item, as will be noted, is much lower than that for the preceding grades.

Onondaga county ranks first among the counties of the State in quantity of output, due principally to the operations of the Solvay Process Co. Its production of marketable salt, however, is comparatively small. The relative rank of the counties according to their output of salt sold as such in 1906 was as follows, in the order of their importance: Livingston, Wyoming, Tompkins, Schuyler, Onondaga and Genesee.

The report of the superintendent of the Onondaga Salt Springs Reservation for the fiscal year ending September 1, 1906, states that a total of 1,817,113 bushels of salt was inspected, as compared with 1,654,448 bushels inspected during the preceding year. The increase was due to the favorable weather conditions which govern the solar salt industry. Some new wells have been put down during the year by the Onondaga Pipe Line Co. to supply manufacturers outside of the reservation. All of the salt made here is marketed through the Onondaga Coarse Salt Association.

Production of salt by grades in 1905

GRADE	BARRELS	VALUE	VALUE PER BARREL
<i>a</i> Common fine.....	1 355 843	\$486 371	\$.36
Common coarse.....	238 149	93 567	.39
Table and dairy.....	1 169 229	684 239	.58
Coarse solar.....	453 206	173 729	.38
Packers.....	37 792	14 477	.38
Other grades.....	5 321 430	850 684	.16
Total.....	8 575 649	\$2 303 067	\$.27

a Includes some coarse solar salt, though the amount is not important.

Production of salt by grades in 1906

GRADE	BARRELS	VALUE	VALUE PER BARREL
<i>a</i> Common fine.....	1 164 064	\$413 462	\$.35
Common coarse.....	182 636	62 758	.34
Table and dairy.....	1 211 936	603 034	.50
Coarse solar.....	510 800	191 551	.38
Packers.....	39 286	14 100	.36
Other grades.....	5 905 271	846 745	.14
Total.....	9 013 993	\$2 131 650	\$.23

a Includes some coarse solar salt, though the amount is not important.

SAND-LIME BRICK

The manufacture of sand-lime brick is an industry that has been only recently introduced in New York State. The first plants were erected about three years ago. Reports have been received from seven companies that were in active operation during the whole or part of the year 1906, showing an output of 17,080,000 brick valued at \$122,340. Two companies listed among the manufacturers failed to make any return as to their production, while one company was engaged in erecting a plant. The following companies comprise all, so far as known, that had plants completed or in course of erection at the close of 1906.

NAME	LOCATION
Granite Brick Co.	Glens Falls
Lancaster Sand-Lime Brick Co.	Lancaster
Newburgh Sand-Lime Brick Co.	Newburgh
Paragon Plaster Co.	Syracuse
Rochester Composite Brick Co.	Rochester
Roseton Sand-Lime Brick Co.	Roseton
F. W. Rourke & Co.	Brooklyn
Sand Stone Brick Co.	Schenectady
Schenectady Brick Co.	Schenectady
Watertown Sand Brick Co.	Watertown

SLATE

Quarries of roofing slate are worked in Washington county near the Vermont state line. The productive district includes a narrow belt running nearly due north from Salem through the towns of Hebron, Granville, Hampton and Whitehall. Efforts have been made to work slate in other parts of the State, particularly in the Hudson river metamorphic region, but for reasons no longer apparent they have not led to the establishment of a permanent industry. Hoosick, Rensselaer co., New Lebanon, Columbia co., and New Hamburg, Dutchess co., are among the places that have furnished slate in the past. At the locality last named, beds were found which yielded large blocks resembling the Welsh slate in color and quality and adapted for structural material, billiard tables, blackboards and other purposes. They were operated as late as 1898.

The slate from Washington county exhibits a variety of colors. Red is the most valuable and is the characteristic product of the region. Owing to its rarity elsewhere, it has a wide sale and is in constant demand for export. This variety is found near Granville and in the Hatch Hill and North Granville districts between North Granville and Whitehall. Its occurrence is confined to areas of Lower Siluric age. Purple, variegated and different shades of green slate are produced from Cambrian areas, principally around Middle Granville, Salem and Shushan. The unfading green which likewise commands a good price for roofing purposes, is quarried to some extent in Washington county, but the greater quantity comes from across the border in Vermont.

Up to the present time the production of slate for other than roofing purposes, such as mantels, billiard tables, floor tiling, blackboards, etc., has not been developed to any extent in this section. It is an important branch of the slate trade of Pennsylvania and Vermont, and there is no doubt that increased attention to this branch would greatly assist the advancement of the industry.

The output of slate in New York State last year amounted in value to \$61,921, consisting of roofing slate \$57,771 and mill stock \$4150. The number of squares of roofing slate made was 16,248. In 1905 the output was valued at \$95,009 and comprised 16,460 squares of roofing slate valued at \$94,009 and \$1000 mill stock. The average value of roofing slate for the year was \$3.56 a square, against \$5.71 a square in 1905. The smaller value last year was due to the relatively light production of red slate, as compared with the cheaper grades.

STONE

The quarry products of New York State rank next in importance to clay manufactures. All of the principal varieties of building and ornamental stones are quarried and most of them on an extensive scale. The production, however, falls short of meeting the requirements for many kinds of stone. Large quantities of granite, marble and limestone are brought in from adjoining states or are imported from foreign countries. With the enormous undeveloped resources, there is abundant opportunity for development of the quarry industries to a scale more nearly commensurate with the market demands.

The statistics and notes incorporated in the following pages relate to the different quarry industries of the State, except those of slate, marl and millstones. Information regarding the slate and millstone industries will be found under their own titles, elsewhere in this report.

Production of stone

The value of the quarry materials produced in 1906 amounted in the aggregate to \$6,504,165. The total for the preceding year was \$6,107,147, showing a gain of \$397,018. The value of the limestone quarried was \$2,963,829, against \$2,411,456 in 1905. The sandstone was valued at \$1,976,829, the greater part contributed by the companies engaged in the bluestone trade. In 1905 the sandstone amounted to a value of \$2,043,960. The output of trap from the Hudson river Palisades, and Richmond and Saratoga counties was valued at \$847,403, against \$623,219 in the preceding year. Marble accounted for a value of \$460,915, considerably less than the total reported for 1905 which was \$774,557. There was little change in the granite industry, the value of the output amounting to \$255,189 against \$253,955 in 1905.

Classified as to uses, crushed stone was the largest item in the total, with an aggregate value of \$2,435,493, an increase of more than \$500,000 over the amount returned for 1905. The use of

crushed stone in road improvement and for making concrete has been the chief factor in the development of this branch of the industry which has about doubled in importance within the last two years. The quantity of crushed stone made last year was approximately 3,132,460 cubic yards, as compared with 2,762,774 cubic yards in 1905. The quantity reported as used for road metal was 905,750 cubic yards, against 1,080,034 cubic yards for the previous year. This total does not represent the full amount thus used, as many of the producers are unable to classify their product. The value of the building stone, rough and dressed, amounted to \$1,408,583 in 1906, against \$1,488,009 in 1905. Curb and flagstone aggre-

Production of stone in 1904

VARIETY	BUILDING STONE	MONU- MENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite.....	\$89 300	\$11 262	<i>a</i>	\$83 295	\$38 025	\$221 882
Limestone.....	248 647	.....	\$6 253	994 475	809 030	2 104 095
Marble.....	278 994	154 673	<i>a</i>	<i>a</i>	45 104	478 771
Sandstone.....	637 607	.....	902 027	27 583	329 480	1 896 697
Trap.....	<i>a</i>	.....	.....	452 621	15 875	468 496
Total.....	\$1 254 548	\$165 935	\$908 280	\$1 557 974	\$1 237 504	\$5 169 941

a Included under "All other."

Production of stone in 1905

VARIETY	BUILDING STONE	MONU- MENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite.....	\$139 414	\$10 431	<i>a</i>	\$69 748	\$34 362	\$253 955
Limestone.....	246 300	.....	\$7 297	1 193 800	964 059	2 411 456
Marble.....	571 810	177 557	<i>a</i>	<i>a</i>	25 190	774 557
Sandstone.....	530 485	.....	1 029 913	37 406	446 156	2 043 960
Trap.....	<i>a</i>	.....	.....	601 669	21 550	623 219
Total.....	\$1 488 009	\$187 988	\$1 037 210	\$1 902 623	\$1 491 317	\$6 107 147

a Included under "All other."

Production of stone in 1906

VARIETY	BUILDING STONE	MONU- MENTAL	CURBING AND FLAGGING	CRUSHED STONE	ALL OTHER	TOTAL VALUE
Granite.....	\$231 190	\$4 119	<i>a</i>	\$13 080	\$5 900	\$255 189
Limestone.....	229 479	.....	\$8 067	1 590 205	1 136 078	2 963 829
Marble.....	337 365	99 100	<i>a</i>	<i>b</i>	24 450	460 915
Sandstone.....	610 549	<i>a</i>	991 611	51 205	323 464	1 976 829
Trap.....	<i>a</i>	.....	.....	780 103	67 300	847 403
Total.....	\$1 408 583	\$103 219	\$999 678	\$2 435 493	\$1 557 192	\$6 504 165

a Included under "All other." *b* Included under Limestone.

gated the sum of \$999,678, as compared with \$1,037,210, represented almost entirely by bluestone. The monumental stone, principally marble, was valued at \$103,219, against \$187,988. The value of the stone quarried for purposes other than those given, including lime, furnace flux, paving blocks, riprap, rubble, etc., was \$1,557,192 as compared with \$1,491,317 in 1905.

Granite

Under the head of granite are included the coarse crystalline rocks in which silicates are the predominant minerals. Besides granite in the true sense the group comprises such rocks as syenite, diorite, anorthosite and various kinds of gneisses, all of which are found in New York State and are commercially utilized for building or other purposes. The variety known as trap is, however, treated by itself.

The aggregate value of the products of the granite quarries in 1906 amounted to \$255,189. Building stone was much the largest item in the total, with a valuation of \$231,190. Among the other uses to which the product was put and the values of each were: monumental stone, \$4119; crushed stone, \$13,980; rubble and riprap \$2423; paving blocks, curbing and miscellaneous, \$3477. The quantity of crushed stone reported was 16,800 cubic yards. Westchester county alone made an output valued at \$172,845, consisting principally of building stone. The remainder of the production was distributed among the following counties: Clinton, Fulton, Herkimer, Jefferson, Orange, Putnam and Warren. There were 19 quarries in all that were operated. In 1905 the value of the product was \$253,955 of which Westchester county contributed \$142,815.

Among the new developments during the past year was the opening of large quarries at Little Falls to supply crushed stone. The material used is syenite, similar to the Adirondack syenite occurrences of which the Little Falls mass is an outlier. The crushing plant erected by the Power & Mining Machinery Co. on the north side of the Mohawk river is the largest in the State, the capacity being 4000 cubic yards a day. The output will be used for road metal, railroad ballast and concrete. It is planned to erect a plant for making concrete brick from the screenings. The West Shore Stone Co. has opened quarries and erected a crushing plant on the south side of the river at Little Falls.

A quarry of monumental stone has been started near Ausable Forks, Clinton co. The material is a green syenite of attractive appearance.

Production of granite

MATERIAL	1904	1905	1906
Building stone.....	\$89 300	\$139 414	\$231 190
Monumental.....	11 262	10 431	4 119
Crushed stone.....	83 295	69 748	13 980
Rubble, riprap.....	30 760	30 125	2 423
Other kinds.....	7 265	4 237	3 477
Total.....	\$221 882	\$253 955	\$255 189

Limestone

The limestone quarries are first in importance among the stone-working industries of the State. Compared with sandstone, which ranks second in value of output, limestone is not so extensively used as a building material, but it finds more extensive employment for road metal and concrete. Its wide occurrence, in connection with natural fitness for the purpose, has favored the development of a large crushed stone business that covers nearly every section of the State. The manufacture of lime also calls for a large part of the product.

The noncrystalline limestones, which alone are considered under this head, comprise a variety of rocks as regards their geological occurrence and physical and chemical characters. They are distributed among the Cambrian, Lower Silurian, Silurian and Devonian systems. In chemical composition they include every gradation from practically pure lime carbonate to magnesian limestones and dolomites and to silicious, aluminous or ferruginous types in which the

Production of limestone

MATERIAL	1904	1905	1906
Crushed stone.....	\$994 475	\$1 193 800	\$1 590 205
Lime made.....	678 225	702 684	795 348
Building stone.....	248 647	246 300	229 479
Furnace flux.....	121 109	198 168	287 816
Rubble, riprap.....	22 230	40 664	32 975
Flagging, curbing.....	6 253	7 297	8 067
Miscellaneous.....	33 156	22 543	19 939
Total.....	\$2 104 095	\$2 411 456	\$2 963 829

carbonates play a subordinate rôle. Light colored and white limestones are not typical of the State, the prevailing colors being grayish or drab, and for this reason considerable quantities are brought in from other states, principally Ohio and Indiana.

The total output of limestone last year amounted in value to \$2,963,829. This is exclusive of the products used in the Portland and natural cement industries, for which no statistics have been collected. Compared with the previous year, there was a gain of \$552,373 in the valuation, or about 23 per cent. The product was distributed among 33 counties of the State, with a total of over 160 quarries.

Crushed stone for road metal, concrete, etc., represents the largest item in the output. The value of this material was \$1,590,205, against \$1,193,800 for 1905. The manufacture of lime is second in importance with a product valued at \$795,348 and \$702,684 for the respective years. The building stone quarried amounted to a value of \$229,479 against \$246,300 in 1905; furnace flux to \$287,816 against \$198,168; rubble and riprap to \$32,975 against \$40,664; flagging and curbing to \$8067, against \$7297; and miscellaneous materials, not classified in the returns, to \$19,939 against \$22,543 in the preceding year.

Distributed according to the counties in which the limestone was quarried, the largest producer last year was Erie county which reported an output valued at \$525,381, consisting principally of building stone, crushed stone and furnace flux. This county also ranked first on the list in 1905 with a valuation of \$383,411. Onondaga county which returned a total value of \$391,457 was second, the same position as in the preceding year when its output amounted to \$310,322. It is the largest manufacturer of lime. The remaining counties which reported a value of over \$100,000 each with their respective totals are here given, the figures in brackets being the corresponding totals for 1905: Dutchess, \$368,927 [\$234,578]; Rockland, \$242,184 [\$220,596]; Genesee, \$227,062 [\$227,087]; Warren, \$205,832 [\$192,136]; Westchester, \$143,168 [\$74,948]; and Albany, \$106,800 [\$101,425].

Lime. There were 38 firms that reported an output, last year, of limestone (including marble) for lime burning, either as a main product or in connection with the quarrying of other materials. The greater portion of the limestone was converted by the companies operating the quarries. In all 18 counties participated in the production. The quantity of lime made was 313,369 short tons, valued at \$795,348. Onondaga county reported a product of 208,-

250 tons, or about 66 per cent. In the previous year the output amounted to 323,905 short tons, valued at \$702,684, of which Onondaga county contributed 193,506 tons. The importance of the industry in this county is to be ascribed to the operations of the Solvay Process Co. which uses the lime as a reagent in the manufacture of soda products.

The production in the other leading counties for 1906 and 1905 respectively was as follows: Warren, 39,076 [38,025] tons; Clinton, 16,400 [16,000]; Washington, 12,000 [12,000]; and Lewis, 9500 [8557].

It will be noted that the value of the production as given above is considerably less than the ruling commercial price; this is due to the fact that a nominal valuation has been placed upon the portion used as a chemical reagent. Disregarding the quantities thus consumed, the value of the lime averaged \$4.58 per short ton in 1906 and \$3.58 in 1905.

Crushed stone. Limestone is more widely employed in New York State for crushing than any other kind of stone. The total production in 1906 amounted to 2,194,547 cubic yards valued at \$1,590,205, as compared with 1,851,008 cubic yards valued at \$1,193,800 in the preceding year. Of the quantities given, 486,750 cubic yards in 1906 and 573,924 cubic yards in 1905 were returned as having been used for road metal, though the actual amount thus used probably exceeded these totals since some plants do not keep any records as to the disposal of their product.

The leading counties in the production of crushed stone with their outputs are as follows, the figures for 1905 being bracketed: Dutchess, 400,177 [335,112] cubic yards; Rockland, 373,387 [335,714]; Genesee, 323,128 [288,000]; Erie, 289,110 [243,628]; Albany, 150,000 [131,000]; Westchester, 105,441 [43,926]; and Onondaga, 92,950 [84,811].

Building stone. The production of limestone for building purposes has remained comparatively steady during recent years. The value of the material quarried in 1906 was \$229,479, against \$246,300 in 1905. Erie county maintains the largest quarries of building stone, its output amounting to a value of \$118,806 as compared with \$103,763 in the preceding year. The remaining counties are small producers. The output each year is supplemented by large quantities of limestone that are brought in from other states.

Furnace flux. The metallurgical industries of the State consume limestone as a flux in smelting operations. The largest users are the iron blast furnaces located in Buffalo and vicinity. The

supply for this district is obtained from the outcrop of the Onondaga limestone in western New York and the adjacent part of the province of Ontario. The principal New York quarries are located at Clarence and Gunnville, Erie co., and at North Leroy, Genesee co. Flux is also obtained at West Chazy, Clinton co., and near Port Henry, Essex co., for use in the Adirondack iron furnaces, and at Oriskany Falls, Oneida co., for the iron furnace at Franklin Springs. The total production of limestone flux in 1906 amounted to 400,002 long tons valued at \$229,479. In the preceding year the amount was 393,667 long tons, valued at \$198,168.

Production of limestone by counties in 1905

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany.....	\$90 800	\$9 600	.....	\$525	\$500	\$101 425
Cayuga.....	13 227	.....	\$240	9 650	11 500	34 617
Clinton.....	4 600	58 000	5 200	9 105	.....	76 905
Dutchess.....	234 578	.....	.....	.....	.....	234 578
Erie.....	153 736	497	96 626	103 763	28 789	383 411
Fulton.....	4 552	11 796	.....	.....	.....	16 348
Genesee.....	127 000	13 260	81 516	2 211	3 100	227 087
Herkimer.....	5 412	5 913	.....	30	1 020	12 375
Jefferson.....	3 951	43 000	.....	6 154	4 650	57 755
Lewis.....	1 432	28 306	.....	658	234	30 630
Madison.....	38 109	.....	.....	5 259	622	43 990
Monroe.....	37 404	.....	.....	8 036	351	45 791
Montgomery..	60 385	.....	115	7 216	.....	67 716
Niagara.....	10 949	4 500	.....	3 055	.....	18 504
Oneida.....	17 243	.....	.....	1 500	.....	18 743
Onondaga.....	39 832	234 308	5 550	17 984	12 648	310 322
Rockland.....	220 596	.....	.....	.....	.....	220 596
St Lawrence...	940	9 650	.....	2 249	3 185	16 024
Saratoga.....	8 500	.....	.....	3 065	205	11 770
Schoharie.....	17 246	.....	50	49 227	272	66 795
Seneca.....	20 330	360	37	3 918	368	7 013
Warren.....	9 463	171 556	.....	10 540	577	192 136
Washington...	39 312	51 000	.....	175	.....	90 487
Westchester...	30 748	43 900	300	.....	.....	74 948
Other coun- tiesa.....	21 455	17 038	8 534	1 980	2 483	51 490
Total.....	\$1 193 800	\$702 684	\$198 168	\$246 300	\$70 504	\$2 411 456

a Includes Columbia, Essex, Greene, Ontario, Orange, Orleans, Rensselaer, Schenectady, Ulster, Wayne and Yates.

Production of limestone by counties in 1906

COUNTY	CRUSHED STONE	LIME MADE	FURNACE FLUX	BUILDING STONE	OTHER USES	TOTAL
Albany.....	\$96 200	\$9 600	.....	\$500	\$500	\$106 800
Cayuga.....	23 098	.....	\$300	11 000	3 000	37 398
Clinton.....	8 350	61 500	15 900	7 175	4 000	96 925
Dutchess.....	368 927	.....	.....	.....	.....	368 927
Erie.....	222 384	375	172 550	118 806	11 266	525 381
Fulton.....	6 963	9 200	.....	.....	.....	16 163
Genesee.....	142 342	14 000	69 650	1 070	.....	227 062
Greene.....	1 785	.....	186	24 500	15 500	41 971
Herkimer.....	4 000	6 300	.....	810	.....	11 110
Jefferson.....	4 875	42 250	.....	6 053	499	53 677
Lewis.....	635	47 000	.....	824	1 025	49 484
Madison.....	20 184	.....	.....	90	1 320	21 594
Monroe.....	52 295	.....	.....	7 564	547	60 406
Montgomery..	55 235	.....	.....	4 116	1 297	60 648
Niagara.....	2 400	40	.....	3 425	10 716	16 581
Oneida.....	32 000	.....	12 600	15 000	.....	59 600
Onondaga.....	63 986	313 500	3 420	8 976	1 575	391 457
Rockland.....	242 184	.....	.....	.....	.....	242 184
St Lawrence...	.....	9 040	3 311	800	911	14 062
Saratoga.....	13 000	.....	.....	3 000	.....	16 000
Schoharie....	21 073	300	.....	10 825	7 875	40 073
Seneca.....	3 301	800	100	2 025	100	6 326
Warren.....	13 347	190 665	.....	1 370	450	205 832
Washington...	36 000	48 000	.....	.....	400	84 400
Westchester...	105 441	36 766	711	250	.....	143 168
aOther co'ties	50 200	6 012	9 088	1 300	.....	66 600
Total.....	\$1 590 205	\$795 348	\$287 816	\$229 479	\$60 981	\$2 963 829

a Includes Columbia, Essex, Ontario, Orange, Rensselaer, Schenectady, Ulster, Wayne and Yates counties.

Marble

The granular crystalline limestones and dolomites which are classed as marble occur in the Adirondack region and in the south-eastern part of the State. They are mainly associated with metamorphosed Precambrian strata. A few varieties of compact limestones, such as the Trenton limestone at Glens Falls and the Chazy limestone of Clinton county, possess ornamental qualities that fit them for special uses and are included under this head.

The quarrying of monumental marble is practically limited to the region about Gouverneur, St Lawrence co. The industry has been established here for many years, and the product has a wide sale. The marble varies from nearly white to dark bluish gray, the dark varieties being the more valuable. As only the best selected stone can be used for monumental work, the poorer grades are dressed into blocks for building and construction purposes.

In southeastern New York the quarries are worked mainly for building stone which is supplied to New York city and other markets in the east. White and gray marbles are the characteristic products. Greenport, Columbia co., South Dover, Dutchess co., and Ossining, Dobbs Ferry, White Plains, Oscawana, Pleasantville and Tuckahoe, Westchester co., are some of the quarry localities.

Production of marble

VARIETY	1904	1905	1906
Building marble.....	\$278 994	\$571 810	\$337 365
Monumental.....	154 673	177 557	99 100
Other kinds.....	45 104	25 190	24 450
Total.....	\$478 771	\$774 557	\$460 915

The production of marble reported by 13 producers amounted in 1906 to a value of \$460,915, divided as follows: building marble, rough and dressed, \$337,365; monumental marble, rough and dressed, \$99,100; other kinds, \$24,450. There was a large falling off in the production as compared with the preceding year when the output was valued at \$774,557. This was due principally to the smaller demand for building stone in New York city. The value of the marble quarried in southeastern New York aggregated \$260,350 against \$464,247 in 1905. St Lawrence county reported an output valued at \$136,835 against \$265,722.

The quarries at South Dover formerly worked by the Dover Chemical & Quarry Co. have been taken over by the Exploitation Co. of America, with a view to reopening them to supply building stone. Development work was prosecuted during the past year and it is intended to begin shipments during the current season. Drill cores show that there is a large quantity of stone available, similar to the marble quarried by the South Dover Marble Co. which finds much favor as a building material. An analysis of the marble, made by E. F. Briggs, has been furnished by the present company and is here given.

Lime (CaO).....	31.36
Magnesia (MgO).....	19.41
Carbon dioxid (CO ₂).....	45.83
Insoluble	3.40

100.00

Sandstone

Under the head of sandstone are included the sedimentary rocks which consist of quartz grains bound together by some cementing substance. Among the principal varieties distinguished by textural characters are sandstones proper, conglomerates, grits and quartzites.

The wide distribution of sandstones in the geologic series of New York State has given them great importance as economical sources of structural materials and in point of annual output they rank second only to limestone. Nearly all of the main formations above the Archean contain these rocks at one or more horizons. The sandstones that are chiefly quarried in New York are the Potsdam, Hudson River, Medina, and the Devonian sandstones. A few quarries have been opened in the Shawangunk conglomerate and the Clinton sandstone. Bluestone is a popular term for the fine grained, evenly bedded sandstones found in the Devonian which have a special application for flagging and curbing and to a lesser extent for building stone.

Production of sandstone

The total value of the sandstone quarried in New York last year was \$1,976,829 as compared with \$2,043,960, the value of the output in 1905. The output was distributed among 35 counties with an aggregate of over 400 producers. Classified as to uses the total was distributed as follows: building stone, rough, \$343,077; building stone, dressed, \$267,472; curbing, \$553,085; flagging, \$438,526; paving blocks, \$282,063; crushed for roads, \$14,677; crushed for other uses, \$36,528; rubble, etc., \$11,661; all other purposes, \$29,740.

The following tables show the value of the production of sandstone in 1905 and 1906, distributed among the leading districts of the State.

Production of sandstone in 1905

DISTRICT	BUILD- ING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
<i>Bluestone</i>						
Hudson river...	\$59 813	\$314 791	\$6 165	.....	.....	\$2 000
Delaware river..	64 084	441 634	2 500	.....	\$4 400	.....
Chenango co...	70 066	76 983	988	.....	2 168	5 473
Wyoming co...	171 620	3 000	.....	.....	930	33 433
Other districts..	36 210	59 641	587	\$1 102	374	11 282
Total bluestone.	\$401 793	\$896 049	\$10 240	\$1 102	\$7 872	\$52 188
<i>Sandstone</i>						
Orleans county..	\$71 679	\$119 390	\$270 964	\$1 282	\$3 500	\$51 290
Other districts..	57 013	14 474	29 565	35 022	16 345	4 192
Total sandstone.	\$128 692	\$133 864	\$300 529	\$36 304	\$19 845	\$55 482
Combined total.	\$530 485	\$1 029 913	\$310 769	\$37 406	\$27 717	\$107 670

Production of sandstone in 1906

DISTRICT	BUILD- ING STONE	CURBING AND FLAGGING	PAVING BLOCKS	CRUSHED STONE	RUBBLE, RIPRAP	ALL OTHER
<i>Bluestone</i>						
Hudson river...	\$70 816	\$220 961	\$14 228	.....	.....	.....
Delaware river..	110 008	572 470	1 350	700	1 188	.....
Chenango co....	85 576	41 985	.....	.....	2 678	.....
Wyoming co....	234 280	.....	.....	550	843	140
Other districts..	12 658	4 247	.....	2 770	.....	325
Total bluestone.	\$513 338	\$839 663	\$15 578	\$4 020	\$4 709	\$465
<i>Sandstone</i>						
Orleans county..	\$50 845	\$147 438	\$260 878	\$225	\$552	\$25 000
Other districts..	46 366	4 510	5 607	46 960	6 400	4 275
Total sandstone.	\$97 211	\$151 948	\$266 485	\$47 185	\$6 952	\$29 275
Combined total.	\$610 549	\$991 611	\$282 063	\$51 205	\$11 661	\$29 740

The value of bluestone quarried for all purposes in 1906 was \$1,377,773 or approximately 70 per cent of the total sandstone; the value of the other sandstone quarried was \$599,056 or 30 per cent of the total. The returns show that there was a falling off in

the amount of sandstone quarried, due to a decrease of all grades produced except curbing and crushed stone. The amount of bluestone produced shows an increase. There was a falling off in the production of the Hudson river district but a gain is shown in the other bluestone districts.

The production of bluestone by districts was as follows: Hudson river, \$306,005; Delaware river, \$685,716; Wyoming county, \$235,813; Chenango county, \$130,239; other districts, \$20,000. Of the sandstone quarried, Orleans county reported a production valued at \$484,938 and other counties an output valued at \$114,118. A more detailed classification of the product that would cover each county separately has been found impracticable, since many of the large companies which operate quarries at several localities are unable to divide their output according to the different sources. The relative rank of the principal counties of the State was, however, as follows in the order of their importance: Orleans, Delaware, Ulster, Wyoming, Sullivan, Chenango, Broome and St Lawrence.

The foregoing table shows that of the bluestone quarried along the Hudson river in Albany, Greene and Ulster counties, about 72 per cent was sold as flagstone and curbstone and about 23 per cent as building stone. In the Delaware river districts, including Sullivan, Delaware and Broome counties, the value of the flagstone and curbstone sold amounted to 83 per cent and the building stone to 16 per cent of the total. In Chenango county about two thirds of the entire product was marketed as building stone and the remaining one third as curbing and flagging. In Wyoming county, on the other hand, almost the entire product was marketed as building stone, the value of the other grades being less than 1 per cent of the total sales. The output of Medina sandstone in Orleans county was used chiefly for the following purposes: building stone, 10 per cent; curbing, 30 per cent; paving blocks, 54 per cent; other purposes, 6 per cent.

Trap

The term trap is commonly applied to the dark fine grained rocks that occur in the form of dikes. In New York State the trap is usually a diabase, a rock composed essentially of plagioclase feldspar and pyroxene, with a massive compact texture. It is very common in the Adirondacks, specially along the Champlain valley in Clinton, Essex and Washington counties. There are numerous occurrences, also, in the region of crystalline rocks in southeastern New York, the largest being the intrusion which borders the west shore of the Hudson river southward from Haverstraw and is known

as the Palisades. The southern end of this intrusion is found in Staten Island, where it extends southwest from Port Richmond.

The principal use of trap is for crushed stone for roadmaking and concrete. It possesses qualities of strength and durability which place it first among the varieties of stone used for these purposes. The sombre color and the difficulty of dressing trap limits its employment in building work. It is used to some extent for paving blocks.

Rockland county produces most of the trap at the present time. The principal quarries are those at Rockland Lake operated by the Clinton Point Stone Co., and the Rockland Lake Trap Rock Co., those at Mt Joy worked by H. M. Gurnee, the Haverstraw quarries worked by the Haverstraw Trap Rock Co. and the Long Clove Trap Rock Co., and the quarries at Nyack operated by the Manhattan Trap Rock Co. The output of the county in 1906 amounted in value to \$780,703.

In Richmond county the Quinroy Construction Co. operates quarries at Port Richmond.

The Saratoga Trap Rock Co. has opened a quarry in the town of Greenfield, 2 miles north of Saratoga Springs, where a dike about 200 feet wide is exposed. This is one of the largest of the Adirondack dikes. At Northumberland in the eastern part of Saratoga county, the Champlain Stone & Sand Co. has begun operations on a partially serpentinized diabase.

The production of trap in New York last year was valued at \$847,403, as compared with a value of \$623,219 reported for 1905, and \$468,496, the value of the output in 1904. Crushed stone was the principal item in the totals, aggregating 851,293 cubic yards valued at \$780,103 in 1906, against 774,111 cubic yards valued at \$601,669 and 610,285 cubic yards valued at \$452,621 in the two preceding years respectively. The greater part of the crushed stone was sold for road material, though the quantities thus used can not be accurately stated.

Production of trap

MATERIAL	1905		1906	
	Cubic yards	Value	Cubic yards	Value
Crushed stone.....	774 111	\$601 669	851 293	\$780 103
Paving blocks etc.....	.....	21 550	.....	67 300
Total.....	.....	\$623 219	.....	\$847 403

TALC

The St Lawrence county mines reported an output in 1906 of 64,200 short tons valued at \$541,600. The yield was somewhat less than in the preceding year, when the total was 67,000 short tons, but the value showed a notable increase due to the higher range of prices. The average selling price for the year on the basis of car-load lots was \$8.43 a ton, as compared with \$7.75 a ton in 1905. The following table gives the annual production and value by years for the period 1896-1906, the figures previous to 1904 being taken from the volumes of the *Mineral Resources*.

Production of talc in New York

YEAR	SHORT TONS	VALUE	VALUE PER TON
1896.....	46 089	\$399 443	\$8 67
1897.....	57 009	396 936	6 96
1898.....	54 356	411 430	7 57
1899.....	54 655	438 150	8 02
1900.....	63 500	499 500	7 87
1901.....	62 200	483 600	6 99
1902.....	71 100	615 350	8 65
1903.....	60 230	421 600	7 ..
1904.....	65 000	455 000	7 ..
1905.....	67 000	519 250	7 75
1906.....	64 200	541 600	8 43

A further consolidation of the mining and milling interests in the talc district was effected during the year by the International Pulp Co., the largest of the producers. Since its organization in 1893 the company has exercised a controlling influence over the industry, though it has not been without active competition from rival concerns. At the time it was formed the properties of the St Lawrence Pulp Co., the Natural Dam Pulp Co., the Agalite Fibre Co. and Adirondack Pulp Co. were acquired and in the following year those of the Asbestos Pulp Co. were also secured. The company thus came into possession of all of the then active interests except the United States Talc Co., which was taken over in August 1906. The latter owned a mine west of Talcville and a mill near Dodgeville. The mill has been recently enlarged by the addition of two cylinders and will restore partially the impairment of productive facilities with which the International Co. met during the past year in loss by fire of its Hailesboro mill. This mill was the

largest and perhaps the best equipped of any in the district. It had a capacity of 75 tons a day. The company also owns three other mills situated at Talcville near its mines.

The Union Talc Co. and the Ontario Talc Co. have been the only producers in recent years aside from those mentioned. It has been reported that both companies have also come under the control of the International Pulp Co. through recent purchase of the capital stock. The Ontario Talc Co. owns three mines and a mill near Fullerville in the central part of the district. The Union Talc Co. has been the largest independent operator since 1900. It was organized as a consolidation of the Columbian Talc Co., American Pulp Co. and Keller Bros., and came into possession of three mines and an equal number of mills. The American mill near Fowler was burned down in December 1905.

A new company was incorporated late in the year for the purpose of mining and manufacture of talc in the St Lawrence county district. According to present plans, the company proposes to work the Freeman mine which has been under lease to the International Pulp Co. A water power on the Oswegatchie river near Dodgeville has been secured, and it is planned to erect a mill of 75 tons daily capacity.

ZINC AND LEAD

The deposits of zinc ore near Edwards, St Lawrence co., have not been worked during the past year. The inactivity has been due to causes which in no way reflect upon the value of the property, and there is a prospect that they will soon be removed and operations resumed once more. The developments thus far have been of the most promising character.

It seems probable that the occurrence is closely related to the pyrite deposits which are found in the schists at Hermon, Gouverneur and other localities in St Lawrence county and which at times carry a small quantity of zinc blende. The schists are metamorphosed Precambrian sediments and are generally associated with crystalline limestone of the same character as the wall rock at the zinc mines. The analogy between the two types of deposits is further emphasized by the presence of pyrite in considerable quantity in the zinc ore.

The deposits of zinc blende occur as replacements of the limestone along or near the contact with a laminated gneiss. They are at times disseminated through the limestone resulting in a lean ore of mixed blende and gangue gradually shading off into the country rock, and again are concentrated in zones which are sharply bounded

and have the appearance of veins. The limestone contains serpentine nodules that have been derived by alteration from a nonhydrous silicate probably pyroxene. The mineralization is no doubt due to underground circulations. These have found passage along the contact between the gneiss and limestone and to a lesser extent along fissures within the limestone. It may be noted that the extensive talc deposits of this section occur on the same limestone belt and in the immediate vicinity of the zinc ore bodies. As has been demonstrated by Prof. C. H. Smyth jr, the talc owes its origin to the influence of subterranean waters acting upon masses of tremolite and pyroxene in the limestone. The evidence is insufficient to justify at present anything as to the precise manner in which the zinc blende has been deposited.

Some work was done during the year on a deposit of galena situated near Pierces Corners, St Lawrence co. The property was worked several years ago, but was abandoned after a little exploration. The former shaft which was bottomed at 80 feet has been pumped out and will be deepened at least 100 feet additional. The work is being done by the Independent Lead Co., of New York city.

The lead mine near Otisville, Orange co., formerly owned by the Washington Mining Co., has been taken over by the Phoenix Lead Co. of Paterson, N. J. It was developed to some extent last year, and it is proposed to instal machinery for continuing the work during the present season.

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New York State Museum

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PUBLICATIONS

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Museum annual reports 1847-date. *All in print to 1892, 50c a volume, 75c in cloth; 1892-date, 75c, cloth.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904-date.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Report for 1904. 138p. 20c. 1905. 102p. 23pl. 30c. 1906. 186p. 41pl. 35c.

Geologist's annual reports 1881-date. Rep'ts 1, 3-13, 17-date, O; 2, 14-16, Q.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899-1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837-41, are out of print.

Reports 1-4, 1881-84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	Price	Report	Price	Report	Price
12 (1892)	\$.50	17	\$.75	21	\$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[See Director's annual reports]	

Paleontologist's annual reports 1899-date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901-3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882-date.

Reports 3-20 bound also with museum reports 40-46, 48-58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3-4, 17 are out of print, other reports with prices are:

Report	Price	Report	Price	Report	Price
1	\$.50	9	\$.25	15 (En 9)	\$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	18 (" 17)	.20
6	.15	12	.25	19 (" 21)	.15
7	.20	13	.10	20 (" 24)	.40
8	.25	14 (En 5)	.20	21 (" 26)	.25
				22 (" 28)	.25

Reports 2, 8-12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867-date.

Bound also with museum reports 21-date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21-24, 29, 31-41 were not published separately.

Separate reports for 1871-74, 1876, 1888-96 and 1898 (Botany 3) are out of print. Report for 1897 may be had for 40c; 1899 for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins [see Bo 5-9].

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), 56th (1902), 57th (1903) and 58th (1904) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

NEW YORK STATE EDUCATION DEPARTMENT

Museum bulletins 1887-date. O. *To advance subscribers, \$2 a year or 1\$ a year for division (1) geology, economic geology, paleontology, mineralogy; 50c each for divisions (2) general zoology, archaeology and miscellaneous, (3) botany, (4) entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	Report	Bulletin	Report	Bulletin	Report	Bulletin	Report
G 1	48, v. 1	Pa 2, 3	54, v. 3	En 11	54, v. 3	Ar 3	52, v. 1
2	51, v. 1	4	v. 4	12, 13	v. 4	4	54, v. 1
3	52, v. 1	5, 6	55, v. 1	14	55, v. 1	5	v. 3
4	54, v. 4	7-9	56, v. 2	15-18	56, v. 3	6	55, v. 1
5	56, v. 1	10	57, v. 1, pt 1	19-22	57, v. 1, pt	7	56, v. 4
6	57, v. 1, pt 1	11-14	58, v. 3			8, 9	57, v. 2
7-10	58, v. 1	23	53, v. 1			9	v. 2
Eg 5, 6	48, v. 1	4	54, v. 1			10, 11	58, v. 4
7	50, v. 1	5-7	v. 3	23, 24	58, v. 5	Ms 1, 2	56, v. 4
8	53, v. 1	8	55, v. 1	Bo 3	52, v. 1		
9	54, v. 2	9	56, v. 3	4	53, v. 1		
10	v. 3	10	57, v. 1, pt 1	5	55, v. 1		
11	56, v. 1	11, 12	58, v. 4	6	56, v. 4		
12, 13	58, v. 2	En 3	48, v. 1	7	57, v. 2, 2		
M 2	56, v. 1	4-6	52, v. 1	8	58, v. 4		
3	57, v. 1, pt 1	7-9	53, v. 1	Ar 1	50, v. 1		
Pa 1	54, v. 1	10	54, v. 2	2	51, v. 1		

The figures in parenthesis in the following list indicate the bulletin's number as a New York State Museum bulletin.

- Geology.** G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. 10c.
- G2 (19) Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. [50c]
- G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. 5c.
- G4 (48) Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. 25c.
- G5 (56) Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. 10c.
- G6 (77) Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. 30c.
- G7 (83) Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. 62p. 25pl. map. June 1905. 25c.
- G8 (84) ——— Ancient Water Levels of the Champlain and Hudson Valleys. 206p. 11pl. 18 maps. July 1905. 45c.
- G9 (95) Cushing, H. P. Geology of the Northern Adirondack Region. 188p. 15pl. 3 maps. Sep. 1905. 30c.
- G10 (96) Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. 54p. il. 17pl. map. Dec. 1905. 30c.
- G11 (106) Fairchild, H. L. Glacial Waters in the Erie Basin. 88p. 14pl. 9 maps. Feb. 1907. 35c.
- G12 (107) Woodworth, J. B.; Hartnagel, C. A.; Whitlock, H. P.; Hudson, G. H.; Clarke, J. M.; White, David; Berkey, C. P. Geological Papers. 388p. 56pl. map. May 1907. 90c., cloth.

Contents: Woodworth, J. B. Postglacial Faults of Eastern New York.

Hartnagel, C. A. Stratigraphic Relations of the Oneida Conglomerate.

—— Upper Silurian and Lower Devonian Formations of the Skunemunk Mountain Region.

Whitlock, H. P. Minerals from Lyon Mountain, Clinton Co.

Hudson, G. H. On Some Pelmatozoa from the Chazy Limestone of New York.

Clarke, J. M. Some New Devonian Fossils.

—— An Interesting Style of Sand-filled Vein.

—— Eurypterid Shales of the Shawangunk Mountains in Eastern New York.

White, David. A Remarkable Fossil Tree Trunk from the Middle Devonian of New York.

Berkey, C. P. Structural and Stratigraphic Features of the Basal Gneisses of the Highlands.

Fairchild, H. L. Drumlins of New York. *In press.*

—— Later Glacial Waters in Central New York. *Prepared.*

Cushing, H. P. Geology of the Theresa Quadrangle. *In preparation.*

—— Geology of the Long Lake Quadrangle. *In press.*

Berkey, C. P. Geology of the Highlands of the Hudson. *In preparation.*

Economic geology. Eg1 (3) Smock, J. C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

Eg2 (7) ——— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p. map. June 1889. *Out of print.*

Eg3 (10) ——— Building Stone in New York. 210p. map, tab. Sep. 1890. 40c.

MUSEUM PUBLICATIONS

DIVISION 2 BOTANY. Torrey, John. Flora of the State of New York; comprising full descriptions of all the indigenous and naturalized plants hitherto discovered in the State, with remarks on their economical and medical properties. 2v. il. pl. sq. Q. Albany 1843. *Out of print.*

v. 1 Flora of the State of New York. 12+484p. 72pl. 1843.

300 copies with hand-colored plates.

v. 2 Flora of the State of New York. 572p. 89pl. 1843.

300 copies with hand-colored plates.

DIVISION 3 MINERALOGY. Beck, Lewis C. Mineralogy of New York; comprising detailed descriptions of the minerals hitherto found in the State of New York, and notices of their uses in the arts and agriculture. il. pl. sq. Q. Albany 1842. *Out of print.*

v. 1 pt1 Economical Mineralogy. pt2 Descriptive Mineralogy. 24+536p. 1842.

8 plates additional to those printed as part of the text.

DIVISION 4 GEOLOGY. Mather, W. W.; Emmons, Ebenezer; Vanuxem, Lardner & Hall, James. Geology of New York. 4v. il. pl. sq. Q. Albany 1842-43. *Out of print.*

v. 1 pt1 Mather, W. W. First Geological District. 37+653p. 46pl. 1843.

v. 2 pt2 Emmons, Ebenezer. Second Geological District. 10+437p. 17pl. 1842.

v. 3 pt3 Vanuxem, Lardner. Third Geological District. 306p. 1842.

v. 4 pt4 Hall, James. Fourth Geological District. 22+683p. 19pl. map. 1843.

DIVISION 5 AGRICULTURE. Emmons, Ebenezer. Agriculture of New York; comprising an account of the classification, composition and distribution of the soils and rocks and the natural waters of the different geological formations, together with a condensed view of the meteorology and agricultural productions of the State. 5v. il. pl. sq. Q. Albany 1846-54. *Out of print.*

v. 1 Soils of the State, their Composition and Distribution. 11+371p. 21pl. 1846.

v. 2 Analysis of Soils, Plants, Cereals, etc. 8+343+46p. 42pl. 1849.

With hand-colored plates.

v. 3 Fruits, etc. 8+340p. 1851.

v. 4 Plates to accompany v. 3. 95pl. 1851.

Hand-colored.

v. 5 Insects Injurious to Agriculture. 8+272p. 50pl. 1854.

With hand-colored plates.

DIVISION 6 PALEONTOLOGY. Hall, James. Palaeontology of New York. 8v. il. pl. sq. Q. Albany 1847-94. *Bound in cloth.*

v. 1 Organic Remains of the Lower Division of the New York System. 23+338p. 99pl. 1847. *Out of print.*

v. 2 Organic Remains of Lower Middle Division of the New York System. 8+362p. 104pl. 1852. *Out of print.*

v. 3 Organic Remains of the Lower Helderberg Group and the Oriskany Sandstone. pt1, text. 12+532p. 1859. [\$3.50]

—pt2. 143pl. 1861. [\$2.50]

v. 4 Fossil Brachiopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 11+1+428p. 69pl. 1867. \$2.50.

v. 5 pt1 Lamellibranchiata 1. Monomyaria of the Upper Helderberg, Hamilton and Chemung Groups. 18+268p. 45pl. 1884. \$2.50.

—Lamellibranchiata 2. Dimyaria of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 62+203p. 51pl. 1885. \$2.50.

—pt2 Gasteropoda, Pteropoda and Cephalopoda of the Upper Helderberg, Hamilton, Portage and Chemung Groups. 2v. 1879. v. 1, text. 15+492p. v. 2, 120pl. \$2.50 for 2 v.

—& Simpson, George B. v. 6 Corals and Bryozoa of the Lower and Upper Helderberg and Hamilton Groups. 24+298p. 67pl. 1887. \$2.50.

—& Clarke, John M. v. 7 Trilobites and other Crustacea of the Oriskany, Upper Helderberg, Hamilton, Portage, Chemung and Catskill Groups. 64+236p. 46pl. 1888. Cont. supplement to v. 5, pt2. Pteropoda, Cephalopoda and Annelida. 42p. 18pl. 1888. \$2.50.

NEW YORK STATE EDUCATION DEPARTMENT

- & Clarke, John M. v. 8 pt1 Introduction to the Study of the Genera of the Paleozoic Brachiopoda. 16 + 367p. 44pl. 1892. \$2.50.
- & Clarke, John M. v. 8 pt2 Paleozoic Brachiopoda. 16 + 394p. 64pl. 1894. \$2.50.

Catalogue of the Cabinet of Natural History of the State of New York and of the Historical and Antiquarian Collection annexed thereto. 242p. O. 1853.

Handbooks 1893–date.

In quantities, 1 cent for each 16 pages or less. Single copies postpaid as below.

New York State Museum. 52p. il. 4c.

Outlines history and work of the museum with list of staff 1902.

Paleontology. 12p. 2c.

Brief outline of State Museum work in paleontology under heads: Definition; Relation to biology; Relation to stratigraphy; History of paleontology in New York.

Guide to Excursions in the Fossiliferous Rocks of New York. 124p. 8c.

Itineraries of 32 trips covering nearly the entire series of Paleozoic rocks, prepared specially for the use of teachers and students desiring to acquaint themselves more intimately with the classic rocks of this State.

Entomology. 16p. 2c.

Economic Geology. 44p. 4c.

Insecticides and Fungicides. 20p. 3c.

Classification of New York Series of Geologic Formations. 32p. 3c.

Geologic maps. Merrill, F. J. H. Economic and Geologic Map of the State of New York; issued as part of Museum bulletin 15 and 48th Museum Report, v. 1. 59x67 cm. 1894. Scale 14 miles to 1 inch. 15c.

— Map of the State of New York Showing the Location of Quarries of Stone Used for Building and Road Metal. Mus. bul. 17. 1897. 10c.

— Map of the State of New York Showing the Distribution of the Rocks Most Useful for Road Metal. Mus. bul. 17. 1897. 5c.

— Geologic Map of New York. 1901. Scale 5 miles to 1 inch. *In atlas form* \$3; *mounted on rollers* \$5. *Lower Hudson sheet* 60c.

The lower Hudson sheet, geologically colored, comprises Rockland, Orange, Dutchess, Putnam, Westchester, New York, Richmond, Kings, Queens and Nassau counties and parts of Sullivan, Ulster and Suffolk counties; also northeastern New Jersey and part of western Connecticut.

— Map of New York Showing the Surface Configuration and Water Sheds. 1901. Scale 12 miles to 1 inch. 15c.

— Map of the State of New York Showing the Location of its Economic Deposits. 1904. Scale 12 miles to 1 inch. 15c.

Geologic maps on the United States Geological Survey topographic base; scale 1 in. = 1 m. Those marked with an asterisk have also been published separately.

*Albany county. Mus. rep't 49, v. 2. 1898. 50c.

Area around Lake Placid. Mus. bul. 21. 1898.

Vicinity of Frankfort Hill [parts of Herkimer and Oneida counties]. Mus. rep't 51, v. 1. 1899.

Rockland county. State geol. rep't 18. 1899.

Amsterdam quadrangle. Mus. bul. 34. 1900.

*Parts of Albany and Rensselaer counties. Mus. bul. 42. 1901. 10c.

*Niagara river. Mus. bul. 45. 1901. 25c.

Part of Clinton county. State geol. rep't 19. 1901.

Oyster Bay and Hempstead quadrangles on Long Island. Mus. bul. 48. 1901.

Portions of Clinton and Essex counties. Mus. bul. 52. 1902.

Part of town of Northumberland, Saratoga co. State geol. rep't 21. 1903.

Union Springs, Cayuga county and vicinity. Mus. bul. 69. 1903.

*Olean quadrangle. Mus. bul. 69. 1903. 10c.

*Becraft Mt with 2 sheets of sections. (Scale 1 in. = $\frac{1}{2}$ m.) Mus. bul. 69. 1903. 20c.

*Canandaigua-Naples quadrangles. Mus. bul. 63. 1904. 20c.

*Little Falls quadrangle. Mus. bul. 77. 1905. 15c.

*Watkins-Elmira quadrangles. Mus. bul. 81. 1905. 20c.

*Tully quadrangle. Mus. bul. 82. 1905. 10c.

*Salamanca quadrangle. Mus. bul. 80. 1905. 10c.

*Buffalo quadrangle. Mus. bul. 99. 1906. 10c.

*Penn Yan-Hammondsport quadrangles. Mus. bul. 101. 1906. 20c.

MUSEUM PUBLICATIONS

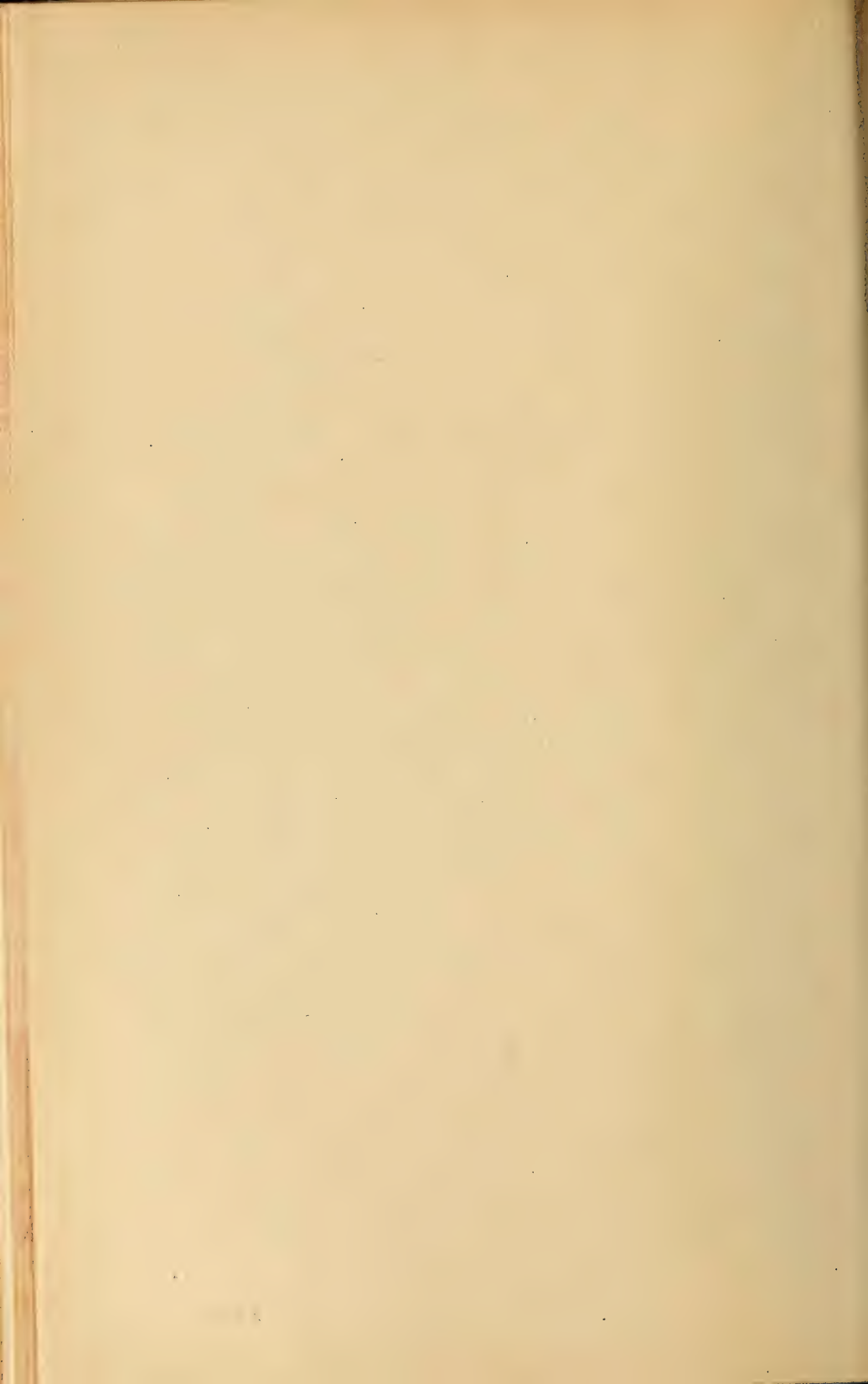
- En7 (26)** — Collection. Preservation and Distribution of New York Insects. 36p. il. Ap. 1899. 5c.
- En8 (27)** — Shade Tree Pests in New York State. 26p. il. 5pl. May 1899. 5c.
- En9 (31)** — 15th Report of the State Entomologist 1899. 128p. June 1900. 15c.
- En10 (36)** — 16th Report of the State Entomologist 1900. 118p. 16pl. Mar. 1901. 25c.
- En11 (37)** — Catalogue of Some of the More Important Injurious and Beneficial Insects of New York State. 54p. il. Sep. 1900. 10c.
- En12 (46)** — Scale Insects of Importance and a List of the Species in New York State. 94p. il. 15pl. June 1901. 25c.
- En13 (47)** Needham, J. G. & Betten, Cornelius. Aquatic Insects in the Adirondacks. 234p. il. 36pl. Sep. 1901. 45c.
- En14 (53)** Felt, E. P. 17th Report of the State Entomologist 1901. 232p. il. 6pl. Aug. 1902. *Out of print.*
- En15 (57)** — Elm Leaf Beetle in New York State. 46p. il. 8pl. Aug. 1902. *Out of print.*
- This is a revision of En4 containing the more essential facts observed since that was prepared.
- En16 (59)** — Grapevine Root Worm. 40p. 6pl. Dec. 1902. 15c.
- See En19.
- En17 (64)** — 18th Report of the State Entomologist 1902. 110p. 6pl. May 1903. 20c.
- En18 (68)** Needham, J. G. & others. Aquatic Insects in New York. 322p. 52pl. Aug. 1903. 80c, cloth.
- En19 (72)** Felt, E. P. Grapevine Root Worm. 58p. 13pl. Nov. 1903. 20c.
- This is a revision of En16 containing the more essential facts observed since that was prepared.
- En20 (74)** — & Joutel, L. H. Monograph of the Genus Saperda. 88p. 14pl. June 1904. 25c.
- En21 (76)** Felt, E. P. 19th Report of the State Entomologist 1903. 150p. 4pl. 1904. 15c.
- En22 (79)** — Mosquitos or Culicidae of New York. 164p. il. 57pl. Oct. 1904. 40c.
- En23 (86)** Needham, J. G. & others. May Flies and Midges of New York. 352p. il. 37pl. June 1905. 80c, cloth.
- En24 (97)** Felt, E. P. 20th Report of the State Entomologist 1904. 246p. il. 19pl. Nov. 1905. 40c.
- En25 (103)** — Gipsy and Brown Tail Moths. 44p. 10pl. July 1906. 15c.
- En26 (104)** — 21st Report of the State Entomologist 1905. 144p. 10pl. Aug. 1906. 25c.
- En27 (109)** — Tussock Moth and Elm Leaf Beetle. 34p. 8pl. Mar. 1907. 20c.
- En28 (110)** — 22d Report of the State Entomologist 1906. *In press.*
- Needham, J. G. Monograph on Stone Flies. *In preparation.*
- Botany. Bo1 (2)** Peck, C. H. Contributions to the Botany of the State of New York. 66p. 2pl. May 1887. *Out of print.*
- Bo2 (8)** — Boleti of the United States. 96p. Sep. 1889. [50c]
- Bo3 (25)** — Report of the State Botanist 1898. 76p. 5pl. Oct. 1899. *Out of print.*
- Bo4 (28)** — Plants of North Elba. 206p. map. June 1899. 20c.
- Bo5 (54)** — Report of the State Botanist 1901. 58p. 7pl. Nov. 1902. 40c.
- Bo6 (67)** — Report of the State Botanist 1902. 196p. 5pl. May 1903. 50c.
- Bo7 (75)** — Report of the State Botanist 1903. 70p. 4pl. 1904. 40c.
- Bo8 (94)** — Report of the State Botanist 1904. 60p. 10pl. July 1905. 40c.
- Bo9 (105)** — Report of the State Botanist 1905. 108p. 12pl. Aug. 1906. 50c.
- Archeology. Ar1 (16)** Beauchamp, W. M. Aboriginal Chipped Stone Implements of New York. 86p. 23pl. Oct. 1897. 25c.
- Ar2 (18)** — Polished Stone Articles used by the New York Aborigines. 104p. 35pl. Nov. 1897. 25c.
- Ar3 (22)** — Earthenware of the New York Aborigines. 78p. 33pl. Oct. 1898. 25c.
- Ar4 (32)** — Aboriginal Occupation of New York. 190p. 16pl. 2 maps. Mar. 1900. 30c.

NEW YORK STATE EDUCATION DEPARTMENT

- Ar5 (41)** — Wampum and Shell Articles used by New York Indians. 166p. 28pl. Mar. 1901. 30c.
- Ar6 (50)** — Horn and Bone Implements of the New York Indians. 112p. 43pl. Mar. 1902. 30c.
- Ar7 (55)** — Metallic Implements of the New York Indians. 94p. 38pl. June 1902. 25c.
- Ar8 (73)** — Metallic Ornaments of the New York Indians. 122p. 37pl. Dec. 1903. 30c.
- Ar9 (78)** — History of the New York Iroquois. 340p. 17pl. map. Feb. 1905. 75c. cloth.
- Ar10 (87)** — Perch Lake Mounds. 84p. 12pl. Ap. 1905. 20c.
- Ar11 (89)** — Aboriginal Use of Wood in New York. 190p. 35pl. June 1905. 35c.
- Ar12 (108)** — Aboriginal Place Names of New York. 336p. May 1907. 40c.
- Civil, Religious and Mourning Councils and Ceremonies of Adoption. *In press.*
- Miscellaneous.** **Ms1 (62)** Merrill, F. J. H. Directory of Natural History Museums in United States and Canada. 236p. Ap. 1903. 30c.
- Ms2 (66)** Ellis, Mary. Index to Publications of the New York State Natural History Survey and New York State Museum 1837-1902. 418p. June 1903. 75c. cloth.
- Museum memoirs** 1889-date. Q.
- 1 Beecher, C. E. & Clarke, J. M. Development of Some Silurian Brachiopoda. 96p. 8pl. Oct. 1889. \$1.
- 2 Hall, James & Clarke, J. M. Paleozoic Reticulate Sponges. 350p. il. 70pl. 1898. \$1. cloth.
- 3 Clarke, J. M. The Oriskany Fauna of Becraft Mountain, Columbia Co. N. Y. 128p. 9pl. Oct. 1900. 80c.
- 4 Peck, C. H. N. Y. Edible Fungi, 1895-99. 106p. 25pl. Nov. 1900. 75c. This includes revised descriptions and illustrations of fungi reported in the 49th, 51st and 52d reports of the State Botanist.
- 5 Clarke, J. M. & Ruedemann, Rudolf. Guelph Formation and Fauna of New York State. 196p. 21pl. July 1903. \$1.50. cloth.
- 6 Clarke, J. M. Naples Fauna in Western New York. 268p. 26pl. map. \$2. cloth.
- 7 Ruedemann, Rudolf. Graptolites of New York. Pt 1 Graptolites of the Lower Beds. 350p. 17pl. Feb. 1905. \$1.50. cloth.
- 8 Felt, E. P. Insects Affecting Park and Woodland Trees. v.1 460p. il. 48pl. Feb. 1906. \$2.50. cloth. v.2 548p. il. 22pl. Feb. 1907. \$2. cloth.
- 9 Clarke, J. M. Early Devonian of New York and Eastern North America. *In press.*
- 10 Eastman, C. R. The Devonian Fishes of the New York Formations. 236p. 15pl. 1907. \$1.25. cloth.
- Eaton, E. H. Birds of New York. *In preparation.*
- Ruedemann, R. Graptolites of New York. Pt 2 Graptolites of the Higher Beds. *In press.*
- Natural history of New York.** 30v. il. pl. maps. Q. Albany 1842-94.
- DIVISION 1 ZOOLOGY.** De Kay, James E. Zoology of New York; or, The New York Fauna; comprising detailed descriptions of all the animals hitherto observed within the State of New York with brief notices of those occasionally found near its borders, and accompanied by appropriate illustrations. 5v. il. pl. maps. sq. Q. Albany 1842-44. *Out of print.*
- Historical introduction to the series by Gov. W. H. Seward. 178p.
- v. 1 pt1 Mammalia. 131+46p. 33pl. 1842. 300 copies with hand-colored plates.
- v. 2 pt2 Birds. 12+380p. 141pl. 1844. Colored plates.
- v. 3 pt3 Reptiles and Amphibia. 7+98p. pt4 Fishes. 15+415p. 1842. pt3-4 bound together.
- v. 4 Plates to accompany v. 3. Reptiles and Amphibia 23pl. Fishes 79pl. 1842. 300 copies with hand-colored plates.
- v. 5 pt5 Mollusca. 4+271p. 40pl. pt6 Crustacea. 70p. 13pl. 1843-44. Hand-colored plates; pt5-6 bound together.

- Eg4** (11) Merrill, F. J. H. Salt and Gypsum Industries of New York. 92p. 12pl. 2 maps, 11 tab. Ap. 1893. [50c]
- Eg5** (12) Ries, Heinrich. Clay Industries of New York. 174p. 2pl. map. Mar. 1895. 30c.
- Eg6** (15) Merrill, F. J. H. Mineral Resources of New York. 224p. 2 maps. Sep. 1895. [50c]
- Eg7** (17) — Road Materials and Road Building in New York. 52p. 14pl. 2 maps 34x45, 68x92 cm. Oct. 1897. 15c.
- Eg8** (30) Orton, Edward. Petroleum and Natural Gas in New York. 136p. il. 3 maps. Nov. 1899. 15c.
- Eg9** (35) Ries, Heinrich. Clays of New York; their Properties and Uses. 456p. 140pl. map. June 1900. \$1, cloth.
- Eg10** (44) — Lime and Cement Industries of New York; Eckel, E. C. Chapters on the Cement Industry. 332p. 101pl. 2 maps. Dec. 1901. 85c, cloth.
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